THE

AMERICAN NATURALIST.

Vol. VII.– MARCH, 1873.–No. 3.

CONTROLLING SEX IN BUTTERFLIES.

BY MRS. MARY TREAT.

That sex can be controlled in butterflies, I think I have demonstrated by careful experiment the past season. Accident first prompted the experiment. Two years ago this past summer, I was feeding a few larvæ of *Papilio Asterias* for the cabinet, when one of my specimens wandered from its food, and rested upon a book to undergo its transformations. Not feeling inclined to give up the book to this purpose, I placed the larva on a fresh stem of caraway; upon removing it from the book, I found its feet were entangled in silk, and that it was in position for a chrysalis, but not yet fastened; so I was surprised to see it commence eating. It continued eating some days longer, before changing to a chrysalis. I then tried others in the same way, and also took off quite a number of larvæ, shutting them away from food. Some of the larvæ that I deprived of food in this first experiment died, but all that completed their transformations were males; while those that I induced to go on feeding by tempting them with the best and freshest food proved to be females.

This season (1872) I commenced with the larvæ the 17th of June, and continued feeding broods of different ages through the month of July. Early in July I had about two hundred larvæ feeding at the same time. The room in which I conducted my experiment faced east and south, and toward noon of each of those excessively hot days in the early part of July, it was several degrees warmer than in the outside air. The food-plant on which I fed the various broods was placed in jars of water, which were

set in a large box partly filled with earth, the whole being covered with deep blue mosquito-netting. Heat and moisture seemed favorable to health and rapid growth.

On the 25th of June one lot of eggs hatched, on the 10th of July they were chrysalides, and on the 18th of the same month the butterflies appeared, only requiring twenty-three days for the complete transformation. On the other hand, I have had this same Asterias butterfly eleven months in coming to maturity; some larvæ that hatched in August, 1871, I fed eight weeks, but the nights were cool and some days were absolutely cold, when the larvæ would not eat. These chrysalides I preserved during the winter, and early in June, 1872, I put them in this same warm room in which the larvæ grew so rapidly, and they were in this room some two weeks before the first larvæ of this season were hatched; and strange as it may appear, some half dozen butterflies of this year's brood came out before these last year's chrysalides produced butterflies.

Very soon after the last moult, I shut a number of the larvæ away from food, putting them in paper boxes, from five to ten in a box, carefully labelled. If, at the end of two or three days, the larvæ were still wandering about, I fed them sparingly; in this way I did not lose a single specimen in the larva state by shutting away from food; a few of the chrysalides died.

It was with the most intense interest that I watched the coming forth of the butterflies, which began to appear in about eight days after assuming the chrysalis stage. Thirty-four males came from my male boxes, and then a rather small female made its appearance. Out of seventy-nine specimens that I labelled males, three females were produced. On the other hand, those that I fed up, keeping them on a good supply of fresh food, I labelled females, and placed them in separate boxes. Out of these boxes sixty-eight females came and four males.

There were some boxes that I marked doubtful, which I do not include in the above figures. For instance, I took five larvæ that were eating vigorously; if let alone they probably would have eaten a day or two longer, but I wished to try them in all stages of growth, and these were of quite a large size; out of these five, four were females.

Soon after the last moult, I took twenty larvæ and shut them away from food for twenty-four hours. At the end of that time I

replaced ten on a good supply of food, watched them carefully, and kept them eating until they attained a large size; they became chrysalides within a few hours of each other, and emerged as butterflies eight days after. One of these chrysalides was accidentally crushed; the remaining nine were females. Of the starved ones, eight males came out; the remaining two chrysalides died.

The butterflies, as fast as they made appearance, were killed and pinned up, the males arranged on one side, the females on the other — a most brilliant display, covering a much larger space than one would be apt to imagine.

It would seem, then, as the result of the whole experiment, that sex is not determined in the egg of insects, and that the female requires more nourishment than the male. Nor does this appear strange, when we consider the reproductive nature of the female. It has frequently been said to me, "if your theory is true, it makes the female higher in the scale — superior to the male." I believe it has always been admitted that the female gives birth to the young. If this is considered superiority, then the female is superior; but if beauty of form and color is taken into account, then the male insect is superior, the same as with birds and the higher animals. Carry the analogy further — up to human beings — and still we find the principle holds good. To which sex belong all our great inventors, statesmen and philosophers? I believe woman is physically incapable, other things being equal, of becoming as profound a philosopher, as deep a thinker, as man. I do not wish it understood that I deem woman inferior to man; there is no inferiority, no superiority. If this matter were better appreciated, we should hear less of "woman's rights," and equality of the sexes, and woman would quietly take her place by the side of her brother, with no contention for rights.

But to return to some corroborations. Toward the last of May, some twenty half-grown larvæ of *Vanessa Antiopa* were brought to me. I placed the branch on which they were feeding in a jar of water, turning a wooden box over them, and thought no more of them for over a week, when I uncovered them and found the branch had fallen from the jar, and the leaves were so dry I could powder them in my hand. More than half of the larvæ were dead; eight poor, starved-looking specimens were alive, and completed their transformations. With this butterfly it is difficult

to distinguish the sex by the marking on the wings, so I dissected them and the result proved them males.

Again, I found a larva new to me, feeding on the soft maple. I obtained thirty-three good specimens. I was very anxious to rear these, so I watched them closely, and plied them with fresh good food; if one fell or wandered from its food I replaced it, and continued this treatment until they would eat no longer. They went into the earth to undergo transformation, and in ten or twelve days thereafter, the rare, beautiful moth, *Dryocampa rubicunda*, made its appearance. Of these there were twenty-nine females and two males. The remaining two either escaped or died in the earth.

About the time these moths came out, another lot of the same Dryocampa caterpillars was brought to me, but these were purposely neglected. I found them more than once wandering about the box in quest of food; some of these were killed by a parasite, others died from lack of food, so that the result proved only seven males, and no female.

THE FLYING SQUIRREL.

BY PROF. G. H. PERKINS.

Over a year ago, I bought of some boys in central Illinois a pair of flying squirrels (*Pteromys volucella* Des.). They were only a few weeks old but were already quite tame; indeed they had never been otherwise for they were taken before they could run from the nest and so were taught to be tame at the outset. Their habits have been very closely watched since I have had them in my possession, for so amusing and interesting are they that it is quite difficult to be in the room where they are without watching their movements. I have noticed some facts in regard to them which I do not find mentioned in any account that I have seen. Intense activity characterizes them at all times, but it is more intense at some times than at others. In warm weather their movements are generally quicker and their exercise continued much longer than in cold. In summer they are more nocturnal in their habits than at other seasons.

During this season they usually lie hidden in the nest all day, rarely making their appearance before dusk, and staying out but a few minutes at a time when they do appear during the day; and what is said hereafter in regard to their activity refers especially to their habits in warm weather, though not untrue for the rest of the year. In the fall and winter months they are less strictly nocturnal, coming from the nest several times each day and taking food and exercise, after which they resume their nap, and at night they alternate sleep and activity in the same manner.

When the sleeping and waking are thus interchanged throughout the day, the squirrels are not as active in their exercise nor does the slumber seem so deep as when they sleep all day and are awake all night. The nest is a hemisphere of wire netting with an opening at the top, filled with tow and cotton. When ready to retire they plunge head foremost into this filling and, by moving from side to side, quickly bury themselves so completely that the top of the nest is left smooth and even, and gives no sign of life beneath so long as the inmates are asleep. If some inquisitive hand pulls off the material covering the squirrels, they are found at the very bottom of the nest, each rolled into as complete a ball as possible, with the broad, feather-like tail curled around one side or thrown over the face. When fairly settled for a nap they are not easily aroused, and all the return they give one for gentle pokes, pushes and strokings is a brisk, querulous scolding in sharp, squealing tones, or a blow or two from a fore paw, and then if they are still further disturbed, one or two quick bites from the sharp needle-like teeth, which, however, are so short and slender that they do not inflict very serious wounds. As has already been stated, they do sometimes come from the nest during the day, when most nocturnal in their habits, especially if thirsty; for, if hungry, they eat some of the many nuts which they have hidden in the nest. In quite marked contrast with their sprightliness of action at night are their sleepy half dazed movements at such times. Often after drinking and hopping about the cage a little, they sit motionless; for perhaps half an hour their eyes staring as if wonderstruck and thus they remain till, with a sudden leap, they bury themselves in the nest.

At dusk they begin to stir. Not all at once it would seem do they awake, for the material of the nest quivers and shakes for sometime before the squirrel appears. When, however, they con-

clude that they are all ready, out pop their heads, each to be followed by the rest of the body, after a glance on all sides with the glistening black eyes; and now all drowsiness has disappeared and an activity more incessant and intense than can be described takes its place. All night long, often with only the briefest rest now and then, these little animals are in vigorous motion, jumping, bounding, capering, running with ever varying movement and astonishing energy. Everything they do is done with all their might. It would seem to any one watching them that the exercise of the first few minutes must wholly exhaust their powers, but, on the contrary, the more their muscles are used, the more capable of use they seem, and great as is the energy of their movements at first, they usually increase in vigor and speed until after midnight and scarcely grow less before morning. Nothing affords them so much gratification as a large wheel which is placed inside the cage. Into this wheel they jump whenever aught disturbs or pleases them, and even when quite hungry they often find it necessary to take a few turns before commencing their meal, after which exercise they draw themselves into a bunch with the tail over the back after the manner of squirrels, and set briskly to work on the nut or other food which they may have received. They are almost as fond of riding as of running and work their passage by running till the wheel is in rapid motion and then clinging to its wires, and so are carried around and around, the pure white of the under side of the body contrasting prettily with the soft brownish-gray of the back and sides as each comes into view. When both are in the wheel one often rides while the other turns the wheel, the latter bounding over the other as each turn brings him around, and, no matter how rapidly the wheel turns, these movements are executed with perfect exactness and gracefulness. Being desirous of knowing with some degree of accuracy how rapidly the wheel moved, I made some experiments for that purpose and found that the usual rate of revolution was from sixty to over a hundred and twenty times a minute, and, as the wheel is forty-four inches in circumference, when its rate is the latter of the two numbers named, the squirrel turning it must travel four hundred and forty feet a minute, or about five miles an hour, a distance requiring a great many steps when they are so short as squirrels must take. The sides of the wheel are formed of spokes radiating as in any wheel, these spokes are only five inches apart at the circumference and of

course constantly grow less towards the centre; yet through this narrow space which passes, when the wheel is at full speed, in the sixteenth of a second, they dart in and out with perfect ease. So quickly do they move that the eye can scarcely follow them; one instant a squirrel is in the wheel running with all his might, and the next he is seated on a shelf at the opposite end of the cage, the wheel whirling behind him. They rarely check the speed of the wheel when wishing to leap out, but when it is in motion and one wishes to enter it, he often clings to one of the spokes and as he is borne around, sidles in. When, as in summer often occurs, the wheel is kept in motion at full speed for nine or ten hours, with very little rest, the distance which the squirrels have travelled is not inconsiderable, being much more than most men could perform day after day, and yet they never seem in the least weary but are ready at any time for a fresh start. Their chief locomotive power resides in the hind pair of legs, which are so powerful that the body can easily be held horizontally by them, the feet clinging to a wire of the cage as the only support of the whole. In most rodent animals the front legs are comparatively weak and are used mainly for holding food, and when the animal is running they seem rather to move in response to the pushing force of the hind legs than to aid very much in propelling the body. They usually move about the cage or room, or in the wheel, by running as other animals would, but sometimes they change this for a series of short leaps, or leaps which again may change into bounds of considerable length; and very graceful are these latter, so light and easy do they appear. Indeed, it is impossible for them to be awkward or clumsy in any of their movements. Though usually very quiet they are not always displeased with noise, if it be a lively one; for instance, they drop a nut in the wheel and then as it rattles when the wheel moves they are highly delighted, sometimes more so than some of the other listeners. Once when a butternut thus became quite a trouble to me I removed it, but no sooner had I left the cage than they put it back and set it rattling louder than ever, leaping over it as it came near them and jumping about as if performing a war dance, and this they repeated over and over again till, finally, the nut was removed from the cage. Now and then the freak takes one or the other to leave the wheel altogether for several days, and in the meantime they relieve their over-buoyant feelings by executing a brilliant series of somer-

sets with an agility and daring that would excite the envy of the most skilful acrobat. They always turn backward, going completely over and alighting almost exactly upon the spot from which they started. Now they run a few steps before going over, and now stop and turn round and round as if a spit ran through the centre of the body on which it turned. These gyrations are often extremely ludicrous, especially, when turning side by side, they seem to be racing. Their heads appear to be wholly ignorant of dizziness or other unpleasant sensations that come from an inverted position, for it never makes much difference with them whether the head is up or down, sometimes taking food hanging head down, and almost always drinking in this position; as they might, when wild, drink from a stream while clinging to the end of an overhanging branch, though it is singular that they should so invariably choose this position, as they drink by lapping up the water as a cat would.

They are so tame that they have very little idea of running away, not always being ready to leave the cage when it is opened to allow them to do so. They are often allowed to run about the room in which they are kept and they are quite fond of running over the furniture, leaping into chairs and off the backs, running over picture cords and the like, being better pleased as they climb higher, and when as high as they can get, off they "fly" to the farthest corner of the room. It is hardly necessary to say that this so called "flying" is in no sense true flight. The extension of skin between the front and hind limbs is not capable of motion like that of a wing of a bird, nor can it raise the body from any surface, but it is simply a support, a parachute, so that the animal can leap from a high position and by a gradual descent reach the ground. So efficient is this support that in the woods these little animals can sail down from a high tree to a bush several hundreds of feet away. They always choose a bush or branch upon which to stop if possible, and even in a room, when descending from a bookcase, they always alight, if possible, on a chair or a person's shoulder rather than upon the floor. Not only when descending but when jumping up does the parachute assist them, and if they are liable to fall they partly extend it. When fully expanded it makes the outline of the body about square, a little longer than broad, but when folded along the side it is not noticeable, as it is covered with fur of the same color as the body, white below and gray above, with a dark line along the edge, and like all the fur of

the body is most beautifully fine and soft. Like the eyes of all squirrels, those of the species under consideration are very large and unusually prominent, standing from the head like great black beads. They seem to be useful both by day and night. Light, even if it be quite bright, does not seem to be an inconvenience, and it is quite certain that they can see very well in the dark, as they leap about the cage and find their food in the darkest night as well as by daylight, and a light brought near them does not seem to affect them disagreeably. The natural food of the flying squirrel consists of nuts, buds, fruits and the like, but they are ready to at least taste of anything that may be offered them, and if it is anything that can be eaten the chances are that it will be. I once found one of them at my inkstand eagerly lapping the ink as if he enjoyed it greatly; pretty soon, however, he left it with sneezings, sniffings and grimaces of a most comical sort, but the very next chance he had he tried to get some more. Salt they eat greedily and also sugar. Beetles they are very fond of and several birds' eggs which I left in their way they devoured, shells and all. They are very neat in all their habits, keeping their faces clean by often rubbing them with the front paws, and the fur of the whole body is always clean and in order.

I am inclined to believe that the flying squirrel does not possess as much intelligence as the gray or red or some other species. Very few of their actions appear to be controlled by anything higher than instinct. They seem to be quite fond of each other, and lonely when separated for any length of time, despite an occasional sharp squabble over some article of food, but they do not evince much attachment for those who feed and care for them. In their rapid and noiseless flitting about the cage they remind one of birds, and their motions are as light and airy, but if disturbed in any way, especially when seated to enjoy a nut, they express their displeasure by a series of quick, sharp squeaks and in their quarrels they scold each other in the same manner. When especially eager to get any food that is held near the cage they run towards it with brisk chuck-chucks, at the same time shaking all over in their anxiety to seize it. More rarely they utter another sound, a clear musical note usually melodious and pleasant but occasionally shrill. This sound very closely resembles the chirp of some birds, so much so that when the windows are open and birds sing-

ing near them, a stranger almost always is deceived as to its source, thinking it caused by the birds outside rather than by the squirrels inside. They keep up this noise for perhaps ten minutes, perhaps half an hour, for no discoverable reason. They are exceedingly inquisitive, prying into everything that comes in their way; and, if watched and fearful lest they are to be interrupted, they assume a most impudent and reckless air, glancing out of one eye, and shaking their heads and sniffing every now and then for an instant, and then returning to their investigations with renewed energy, pulling away desperately at anything that can be laid hold of, and if anyone starts towards them to drive them away, they wait till the very last minute, when, with a twinkle of the eye, a toss of the head and jerk of the tail, they are off and across the room in a trice, perhaps stopping to chatter their disapproval of the whole proceeding as soon as safely out of reach. It is difficult, if not impossible, to so conceal nuts or corn that they do not immediately discover them and dig and pull and push at whatever contains them till they get them. It must be by the aid of their keen scent that they are thus able to detect the food when closely covered in a box. When their exertions have been successful, they do not allow anything that can be eaten, to remain where they have found it, however snug the place may be, but carry it off to some other place of their own choosing. One evening they carried over sixty walnuts, from a box in which they were kept, across the room and by climbing the handle of a feather duster reached a bracket on which was a large vase, and into this they put the nuts, one by one, giving each a rapping against the vase as it was left.

When the actions of an animal are so suddenly varied, so constantly changing and of such interest in all their phases as are those of the flying squirrel, a complete account can scarcely be given. Certainly it is not easy for words to represent the merry, rollicking, don't-care manner in which these flying squirrels do everything. Such a combination of earnestness and carelessness is seldom seen. For they are earnest about their work, and in emptying a box of nuts they seem to feel the great importance of their undertaking and the necessity of soberness and dignity in its execution, but yet one can not help seeing that all this is but assumed for the occasion, for their eyes, and indeed their whole body, are all the time expressive of mischief, and the little rogues

are never so sedate that they do not seem to be bubbling over with fun and to be ready at a moment's notice to engage in any mischief that may occur to their scheming little heads.*

INDIAN NETSINKERS AND HAMMERSTONES.†

BY CHARLES RAU.

THE two kinds of Indian stone implements which form the subject of this article are by no means remarkable for skilful workmanship, and therefore, probably, have thus far attracted little notice in this country. In archæology, however, every object that can serve to illustrate the former condition of a people is of significance, and it matters not whether that object is elaborately finished or has suffered but little alteration by the hand of man. I place netsinkers and hammerstones together, because the specimens in my possession, which form the basis of my description, were derived from the same locality, namely, both banks of the Susquehanna river near the small town of Muncy, in Lycoming County, Pennsylvania. I possess a great number of the above-named implements of all shapes and sizes, which were sent to me by Mr. J. M. M. Gernerd, a resident of Muncy. To this gentleman I am also indebted for the communication of the details which enable me to furnish the following account.

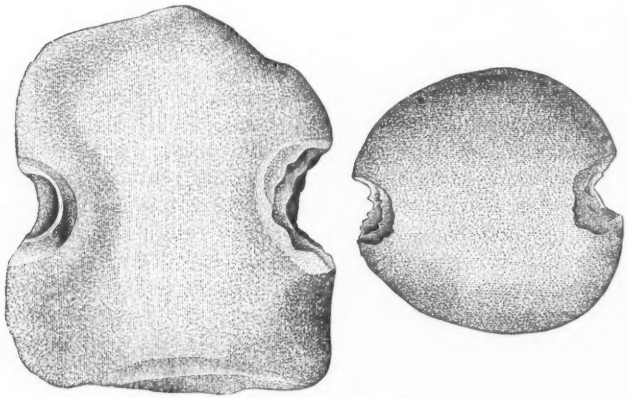
*Since the main portion of this article was written, one of the pets has died. It is the female that is lost — the tamest and best natured, but least sprightly of the pair. It is to be feared that she was killed by kindness, as she had been fed on soft food much of the time, and so did not have to crack nuts for a living. A post mortem showed that the body was covered with thick layers of fat; and more than this, that the abdominal cavity was more than half filled with solid masses of fat; so as there was no other visible cause for her decease, the inference is that she died of *adiposity*. It is sad to say aught that may diminish any one's admiration for these really charming animals, but truth requires me to say that I have watched in vain for any signs of grief in the remaining squirrel. He sleeps as soundly and performs his various gymnastics as gleefully as ever. The only difference in his conduct I am able to detect is, that whereas formerly he instantly seized any and everything that was offered, he is now quite particular, entirely refusing many articles that used to be a part of his diet. It may be that grief affects his appetite; but it is to be feared that, having discovered that there is no one to snatch his food if he does not eat it, he takes time to choose that which is most agreeable. At any rate all the evidence goes to show that these really attractive creatures do not possess any deep affection even for each other.

†Translated by the Author from Vol. V of the "Archiv für Anthropologie."

Netsinkers and hammerstones are found in various localities of the United States; but I am not aware that they occur in any other place as frequently as in the neighborhood of Muncy. Netsinkers have been taken away from there by the hundred, and yet their number is not exhausted; hammerstones, however, although likewise numerous, occur there less frequently. The other productions of primitive art, which always indicate the former presence of the Indians, such as stone tomahawks, wedge-shaped stone implements, flint arrowheads, fragments of coarse pottery, etc., are also found in the environs of Muncy.

The netsinkers in question are flat pebbles of roundish or angular (generally indefinite) shape and of various sizes, which exhibit

Fig. 30. Fig. 31.



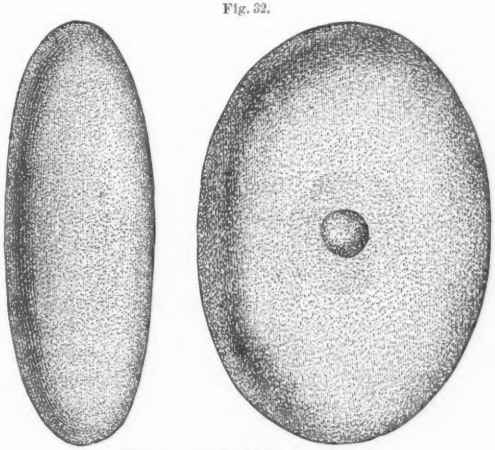
Netsinkers (one-half natural size).

on two opposite points of the circumference an indentation or notch, more or less deep, and produced by blows. Besides the notches, which facilitated the attachment to the nets, these pebbles have not undergone the slightest change by human agency; and their manufacture, therefore, required but little labor and skill. My smallest specimen measures two inches in diameter and weighs only half an ounce; my largest one, a flat stone of irregular outline, is eight inches wide across the broadest part and weighs two pounds and fourteen ounces. I must mention, however, that the last-named specimen is unusually large and heavy, the average size

of the sinkers being from three to five inches, with a corresponding weight of from six to ten ounces.

Figures 30 and 31 represent netsinkers of my collection in half-size, which weigh respectively eleven ounces and seven ounces and a quarter. The original of Fig. 30 is in the middle five-eighths of an inch in thickness, that of Fig. 31 is about seven-eighths of an inch thick. Sinkers with four notches also occur near Muncy, though not very frequently, and in these cases the notches are so placed that the stone was encompassed crosswise by the strings or thongs which connected it with the net. One of the specimens found at Muncy is even provided with seven indentations. The

Fig. 32.



Hammerstone (one-half natural size).

material of these netsinkers is almost exclusively a flat-breaking silico-argillaceous stone of gray or brownish color, sometimes containing diminutive particles of mica, and consequently bearing the distinct character of graywacke. The latter kind of rock belongs to the geological formation of Muncy, and occurs also in numerous pebbles in the neighboring creeks, which empty into the Susquehanna. The Indians, therefore, had little difficulty in obtaining the stones used as sinkers.

No greater skill was required in the manufacture of the hammerstones. They are nearly always roundish or oval pebbles of a somewhat compressed or flattened form, presenting in their side-view

the outline of a more or less elongated ellipse. Their only artificial alteration consists in two small pits or cavities, so placed as to form the centres of the opposite broad sides of the pebble. In these cavities the workman placed the thumb and middle finger of the right hand, while the forefinger pressed against the upper circumference of the stone. Figure 32 (two views) is a half-size drawing of one of these hammerstones, and may serve to represent their general character. The original of Figure 32, however, is one of the larger specimens, measuring a little more than five inches in longitudinal diameter, and weighing one pound and ten ounces. Most of the hammerstones are smaller and lighter, averaging about a pound in weight. My smallest specimen, almost circular and with a diameter of two inches and three-quarters, weighs only half a pound. Concerning the cavities on the opposite sides, I will state that the makers evidently chiselled them out, as it were, with a tool of hard stone, doubtless a pointed flint, for which reason they sometimes appear rough and irregular. In the more finished specimens, however, they exhibit regular cup-like concavities, obviously produced by grinding. In some instances the depressions are so shallow that they almost escape observation, while they reach in other cases from eight to nine millimetres into the stone, and thus afford the hand a firm hold. Yet quite a number of the hammerstones under notice exhibit, instead of the cup-shaped cavities, on the opposite broad sides, *roughly* ground faces, sometimes several inches in diameter, and answering well the purpose of allowing the hand a secure grasp of the stone. Many of the hammerstones bear the distinct traces of use, being battered and crumbled at the circumference; and a few of the specimens in my possession are even burst as far as the centre by the force of the blows dealt with them. The material of the hammerstones of Muncy is a tolerably hard stone consisting of rounded quartz grains, apparently a metamorphic quartz, or quartzite.

In Europe, it is well known, similar hammerstones occur, which have been called *Tilhuggerstene* by Danish archæologists.* Prof. Nilsson has minutely described these implements, and tried to prove they had been used in chipping weapons and tools of flint.

*Drawings of European hammerstones resembling those of the Indians are found in the following works — Nilsson: The Primitive Inhabitants of Scandinavia (London 1868), Pl. I, Fig. 1; Worsaae: Nordiske Oldsager etc. (Copenhagen 1859), Figs. 32, 33; Stevens: Flint Chips (London 1870), Fig. 122; Evans: The Ancient Stone Implements, etc. of Great Britain (London 1872), Figs. 161, 164.

It is not my intention to enter here into a discussion concerning the views of the meritorious Swedish archæologist: I will merely state my opinion in regard to the probable use of the hammerstones from the Susquehanna valley. That these latter were employed as hammers cannot be doubted, since they show the most distinct traces of violent contact with hard substances; yet, according to my view, it was almost impossible to employ them *immediately* in fashioning flint implements. They are by far too clumsy, and possess too much roundness on all sides to have been the tools for fabricating arrowheads and other delicate articles of flint.* Not even the rude notches in the netsinkers could have been produced by their immediate application. Nevertheless, they may have served, besides fulfilling other purposes, as *coöperating* tools in the manufacture of flint implements. Mr. Catlin has described the method employed by the Apaches and other western tribes in making flint points for arrows and spears. The work, he states, is performed by two persons, one of whom holds the piece of flint to be operated upon in the left hand and places with the right hand a chisel or punch (made of a tooth of the sperm-whale) against the protuberances of the flint, which are to be removed, while his assistant strikes the chisel on the upper end with a mallet of hard wood and thus flakes off the projecting points. This process is continued until the article has acquired the desired shape.† A similar method, perhaps, was in use among certain Indians inhabiting the eastern parts of North America, and in this case the hammerstones may have replaced the wooden mallets mentioned by Catlin.

Yet while I doubt the immediate application of these heavy hammerstones in the manufacture of flint points, I do not deem it altogether improbable that they were directly used as hammers for chipping certain rude implements of graywacke, or a kind of tough slate, which occur in great abundance in the neighborhood of Muncy. These implements are of various shapes, mostly wedge-like in form, and are sometimes quite large. Many of them have

*Among my specimens from Muncy there is a hammerstone of flint, which may have been used directly in making arrowheads. It is a nearly round, somewhat flat stone, two inches and three-eighths in diameter, and weighing six ounces and a quarter. The edge or rather circumference is much battered by continued use. Similar flint hammerstones found in England, are figured on page 223 of Mr. Evans' new work, "The Ancient Stone Implements, Weapons, and Ornaments of Great Britain."

†Catlin: Last Rambles amongst the Indians, New York, 1867, p. 187.

distinct scraper-edges, and probably were used in the preparation of hides and for other kindred purposes. I further believe that there is a certain connection between the netsinkers and hammerstones of Muncy, in so far as the latter served in the manufacture of the former. Two workmen, I imagine, were active in the operation. One held the pebble, its narrow side upward, firmly in the hand; the other placed a piece of flint of suitable shape and strength at the spot where the notch was to be cut out, and gave the flint wedge a heavy blow with the hammerstone, thus effecting the indentation. In this manner a great many sinkers could be made in a short time.

From the great number of netsinkers found near Muncy, it may be deduced that the Indians were much engaged in fishing at this point. Indeed, the Susquehanna is here about nine hundred and fifty feet wide, very deep in some places, and well stocked with fish, among which I will mention perch, pike, sunfish, catfish, and eels. There existed formerly a shad-fishery near Muncy, before the river was obstructed by dams. Salmon is still sometimes caught. Formerly, however, fish were still more abundant, and the locality, therefore, afforded the aborigines great advantages as a fishing-station. When the first white settlers penetrated to this region, they found on or near the present site of Muncy a village of the Minsi or Munsey Indians, the Wolf tribe of the great Leni-Lenape or Delaware nation. The name "Muncy," indeed, perpetuates the tribal designation of those aboriginal predecessors, whose scanty descendants now dwell, far from the home of their fathers, in the districts beyond the Mississippi. The Minsi Indians, I think, may be considered as the manufacturers of the stone implements described in these pages.

Netsinkers of stone are even in our time in use among certain tribes of the northwest coast of North America; as for instance, among the Chinooks (at the mouth of the Columbia river), who attach them to their salmon-nets. "Their nets," says Mr. Swan, "are made of a twine spun by themselves from the fibres of spruce roots prepared for the purpose, or from a species of grass brought from the north by the Indians. It is very strong, and answers the purpose admirably. Peculiar-shaped sticks of dry cedar are used for floats, and the weights at the bottom are round beach pebbles, about a pound each, notched to keep them from slipping from their fastenings, and securely held by withes of cedar firmly twisted and

woven into the foot-rope of the net. The nets vary in size from a hundred feet long to a hundred fathoms, or six hundred feet, and from seven to sixteen feet deep." *

Fishing-nets may be counted among the utensils invented at very early periods, on the spur of necessity, by men in various parts of the world. That they were already in use in Europe at a remote time of antiquity is proved by their remnants preserved in an almost marvellous manner in the Swiss pile-constructions of the stone age, as, for instance, those of Robenhausen and Wangen. In the earliest works on North America the fishing-nets of the Indians are mentioned, but not described. Cabeça de Vaca, the first European who gave an account of the interior of North America, refers in various places, though in a transient manner, to the nets of the natives whom he met during his long wanderings.† Garcilasso de la Vega and the anonymous Portuguese gentleman, called the Knight of Elvas, the two principal authors who have left accounts of De Soto's expedition (1539–43) are likewise deficient in all such details as might serve to illustrate the original character of Indian nets. The latter relates, however, that the Spaniards, while at a place near the Mississippi, called Pacaha (Garcilasso has it "Capaha"), caught fish in a lake with nets furnished by the Indians.‡ This establishes at least the fact that the tribes of the Mississippi valley employed fishing-nets, when first seen by Europeans. The Indians of the present New England States made strong nets of hemp. For this we have the authority of Roger Williams, who gives also the word *ashóp*, which signifies a net in the language of the Narragansetts.§ Yet it appears that the Indians of the Atlantic Coast (and others) practised more the "spearing" of fish than their capture in nets. Some were also killed by arrow-shots.‖ According to Van der Donck,¶

* Swan: The Northwest Coast, New York, 1857, p. 104.

† Relation et Naufrages d'Alvar Nuñez Cabeça de Vaca (Ternaux-Compans), Paris, 1837, pp. 24, 142, 177, 179. Original printed at Valladolid in 1555.

‡ Narratives of the Career of Hernando de Soto, etc., translated by Buckingham Smith, New York, 1866, p. 112.

§ Roger Williams: A Key into the Language of America, London, 1643; Providence, R. I., 1827, p. 102.

‖ The practice likewise prevailed of erecting in the water large labyrinth-like enclosures of lattice-work, flanked by long weirs, the whole forming a sort of gigantic trap, into which the fish were driven. Such a contrivance of the Virginia Indians is figured and described in the first volume of De Bry's "Peregrinationes" (Frankfort on the Main, 1590).

¶ Beschryvinge van Nieuw-Nederlandt, Amsterdam, 1656, p. 70.

the Indians in the neighborhood of New Amsterdam (now New York) employed, during the middle of the seventeenth century, various kinds of nets; but this author does not state whether these nets were original Indian inventions, or adopted from the Dutch colonists. The Natchez, on the Lower Mississippi, made their nets from the bark of the linden tree, and knitted them quite in the European fashion.*

Reverting, in conclusion, once more to netsinkers, I will mention that in the United States there also occur some provided with a perforation, instead of being notched. I had occasion to examine in the collection of Col. Charles C. Jones, of Brooklyn, a number of the perforated kind, which the owner had found in Eastern Georgia, at the confluence of the Great Kiokee Creek with the Savannah river, a spot where Indian relics abound. The material of these sinkers is the talcose stone commonly called soapstone. They consist of flat smoothed pieces, of indefinite but mostly rounded outline, which are an inch or less in thickness, and measure from three to six inches in diameter. The holes are usually drilled from two sides, and therefore narrowing in the middle, where they are about half an inch wide. Col. Jones will figure and describe these Indian implements in his forthcoming work on the antiquities of the State of Georgia.

THE FOSSIL MAMMALS OF THE ORDER DINOCERATA.†—*With Two Plates.*

BY PROFESSOR O. C. MARSH.

Among the many extinct animals of interest hitherto discovered in the Tertiary of the Rocky Mountain region, none, perhaps, are more remarkable than the huge mammals which have recently been described from the Eocene beds of Wyoming. It is important, therefore, that accurate information in regard to them should be promptly made public, especially as serious errors on this subject have already appeared in various scientific publications, and are being widely disseminated.

* Du Pratz: Histoire de la Louisiane, Paris, 1758. Vol. II, p. 179.

† Published in part in the "American Journal of Science," Vol. V, p. 117, Feb., 1873.

These animals nearly equalled the elephant in size, and had limb bones resembling those of Proboscidians, as stated in the original description of the type species, *Tinoceras anceps* Marsh. The skull, however, presents a most remarkable combination of characters. It is long and narrow, and supported three separate pairs of horns. The top of the skull is concave, and on its lateral and posterior margin there is an elevated crest. There were large decurved canine tusks, somewhat resembling those of the walrus, but no upper incisors. The six premolar and molar teeth are quite small. Several species of these remarkable animals have already been named, but at present they cannot all be distinguished with certainty. The type species of the group (*Tinoceras anceps* Marsh) was based on the specimen first discovered; which was found by the Yale College party in September, 1870, and described by the writer in June, 1871, under the name *Titanotherium? anceps*.* In the following year Professor Cope gave the name, *Loxolophodon semicinctus*, to a single premolar tooth, which perhaps, belongs to this group, and may prove to be identical with the above species.† In August last, in a paper issued in advance of the Proceedings of the Philadelphia Academy, Dr. Leidy described a characteristic specimen as *Uintatherium robustum*, and likewise gave the name *Uintamastix atrox* to an upper canine tooth, probably of the same animal, on the supposition that it pertained to a carnivore.‡

The remarkable feature in the skull of this group was first indicated in the name *Tinoceras*, proposed by the writer (August 19, 1872) for the genus represented by the type species, and subsequently mentioned in the American Journal of Science.§

The Museum of Yale College contains the remains of many individuals of the order *Dinocerata*, including the types of the various species described by the writer.‖ All of these are well represented by characteristic specimens, and one species, *Dinoceras mirabilis* Marsh, by an entire skull, and a nearly perfect skeleton. An opportunity has thus been afforded of determining with some

* American Journal of Science, Vol. ii, p. 35.
† American Philosophical Soc., Vol. xii, p. 420.
‡ Proceedings Philadelphia Academy, 1872, p. 169.
§ Vol. iv, September, 1872, Erratum; also October, 1872, p. 322.
‖ American Journal of Science, vol. iv, pp. 322, 323, 343, Oct., 1872. Also Proceedings American Philosophical Society, vol. xii, p. 578, Dec., 1872, and American Naturalist, vol. vii, p. 52, Jan., 1873.

certainty the nature and affinities of this most singular group of animals, and the more important characters are here mentioned, preliminary to the full description. Most of the cranial characters are derived from a very perfect skull of *Dinoceras mirabilis*, figured in the accompanying plates.

The skull is unusually long and narrow. The three pairs of horn-cores, rising successively above each other, and the huge crest around the deep concavity of the crown, together with the large decurved trenchant tusks, unite in giving a most remarkable appearance to the entire head (Plates I, II), which differs widely from anything known among living or fossil forms.

The structure of the skull presents many features of interest. The supraoccipital is greatly developed, and, after rising above the brain-case, forms an enormous crest, which projects obliquely backward beyond the condyles. This crest is continued forward on either side, each lateral portion sloping outward, and overhanging the large temporal fossa. This portion of the crest is formed largely of the parietals. The posterior pair of horns rise from this crest, which is thickened below on the inner side to support them. In front of these horns, the crest descends rapidly, and subsides nearly over the centre of the orbit. These posterior horn-cores are higher than those in front, and have obtuse summits, flattened transversely. (Plates I, II.) The frontal bones have no postorbital process, and the orbit is not separated from the temporal fossa. The latter is very large posteriorly. (Pl. II, fig. 1.) The squamosal forms the lower portion of the temporal fossa, and sends down a massive post-glenoid process. It likewise sends forward a zygomatic process, which resembles that of the tapir. The malar completes the anterior portion of the arch, which is not the case with any known Proboscidian. The lachrymal is large, and forms the anterior border of the orbit, as in the rhinoceros. It is perforated by a large foramen on its facial surface. Over the orbit, the frontal sends out laterally a prominent ridge, which afforded good protection to the eye in the combats of these animals with each other. On this ridge there is a small protuberance, which closely resembles a diminutive horn-core, but its position, immediately in front of the lateral crest, renders it probable that it did not support a true horn.

The maxillaries are massive, and quite remarkable in supporting a pair of stout, conical horn-cores. The bases of these cores

approximate, and their summits are obtuse and nearly round. (Plates I, II.) Below these horns are the huge decurved canines, the extremity of the fang being implanted in the base of the horn-core. Behind the canine, there is a moderate diastema, followed by six small premolar and molar teeth. The crowns of the molars are formed of two transverse ridges, separated externally, and meeting at their inner extremities. The nasals are massive, and greatly prolonged anteriorly. In front of the zygomatic arch they contract, and form the inner inferior surface of the maxillary horn-cores, as well as an elevation between them. From this point forward to the anterior margin of the suture with the premaxillary, they increase slightly in width, and then contract to the end of the muzzle.

Near the anterior extremity of the nasals, there is a pair of low tubercles, which evidently supported dermal horns (Pl. II, fig. 3). The premaxillaries are without teeth, and quite peculiar. They unite posteriorly with the maxillaries just in front of the canine, and then divide, sending forward two branches, which partially enclose above and below the lateral portion of the narial opening. The upper branch is closely united with the adjoining nasal, thus materially strengthening the support of the nasal horns. The lower portion is slender, and resembles the premaxillary of some Ruminants. The extremity is somewhat behind that of the nasals. The anterior nares are comparatively small, the aperture being more contracted than in the rhinoceros. The lower jaw was slender, and the tusks small.

The extremities in the *Dinocerata* resembled those in the *Proboscidea*, but were proportionally shorter. The humerus was short and massive, and in its main features much like that of the elephant. One of the most marked differences is seen in the great tuberosity, which does not rise above the head, and is but little compressed. The condylar ridge, moreover, of the distal end is tubercular, and not continued upward on the shaft. The lower extremity of the humerus is much like that of the rhinoceros, and the proportions of the two bones are essentially the same. The head of the radius rests on the middle of the ulnar articulation, and hence the shaft of this bone does not cross that of the ulna so obliquely as in the elephant. The femur is proportionally about one-third shorter than that of the elephant. The head of this bone has no pit for the round ligament, and the great trochanter is flattened and recurved. There is no indication of a

third trochanter. The distal end of the femur is more flattened transversely than in the elephant, and the condyles are more nearly of the same size. The corresponding articular faces of the tibia are consequently about equal, and also contiguous, with no prominent elevation between them. When the limb was at rest, the femur and tibia were nearly in the same line, as in the elephant and man. The astragalus has no distinct superior groove. Its anterior portion has articular faces for both the navicular and cuboid, thus differing from Proboscidians, and agreeing with Perissodactyls. The calcaneum is very short. The phalanges are short and stout, and resemble somewhat those of the elephant.

The vertebræ of this group are not unlike those of Proboscidians in their main characters. The cervicals are materially longer than in the elephant. There are four sacral vertebræ, the last quite small, and supporting a short and slender tail. The ribs have rudimentary uncinate processes, as in the mastodon.

Such being the more important characters of these gigantic fossil mammals, it remains to state briefly what these characters collectively indicate, and likewise to give reasons for placing the group in an order distinct from the *Proboscidea*.

The vertebræ and limb-bones in the *Dinocerata* are in many respects remarkably like those of Proboscidians, the exceptional characters being those of the Perissodactyl type. The skull, on the contrary, presents no distinctive proboscidian features. The presence of horns in pairs, and the absence of teeth in the premaxillaries together with the large canine, point toward the Ruminants. The nasal horns, the structure of the anterior portion of the skull, the molar teeth, the zygomatic arch, the elongated temporal fossæ, the large post-glenoid processes, as well as other less important cranial characters, show affinities with the Perissodactyls. The horns on the maxillaries, the deep concavity of the crown, and the huge lateral crests are quite peculiar to this order.

Some of the most marked characters that distinguish these animals from the *Proboscidea* are the following:—1st, The absence of upper incisors. 2d, The presence of canines. 3d, The presence of horns. 4th, The absence of large air cavities in the skull. 5th, The malar bone forms the anterior portion of the zygomatic arch. 6th, The presence of large post-glenoid processes. 7th, The large perforated lachrymal, forming the anterior portion of the orbit. 8th, The small and horizontal narial orifice. 9th, The greatly elongated nasal bones. 10th, The premaxillaries do not

meet the frontals. 11th, The lateral and posterior cranial crests. 12th, The very small molar teeth, and their vertical replacement. 13th, The small lower jaw. 14th, The articulation of the astragalus with both the navicular and cuboid bones. 15th, The absence of a hallux. 16th, The absence of a true proboscis. The last character may be fairly inferred from the short anterior limbs, the moderately lengthened neck, and the very elongated head, which rendered a proboscis unnecessary, as the muzzle could readily reach the ground. The small nasal opening — smaller even than that of the rhinoceros or tapir—also testifies against it, while the nasal horns, and the sharp decurved canines would seriously have interfered with such an organ, had it been present.

The horns of the *Dinocerata* were a remarkable feature. Those on the nasal bones were probably short, dermal weapons, something like those of the rhinoceros, but much smaller. Those on the maxillaries were conical, much elongated, and undoubtedly formed most powerful means of defence. The posterior horns were the largest, and their flattened cores indicate that they were expanded, and perhaps branched. All the horn-cores are solid, nearly smooth externally, and none of them show any indication of a burr. Whether both sexes had horns, cannot at present be decided, but this was probably the case.

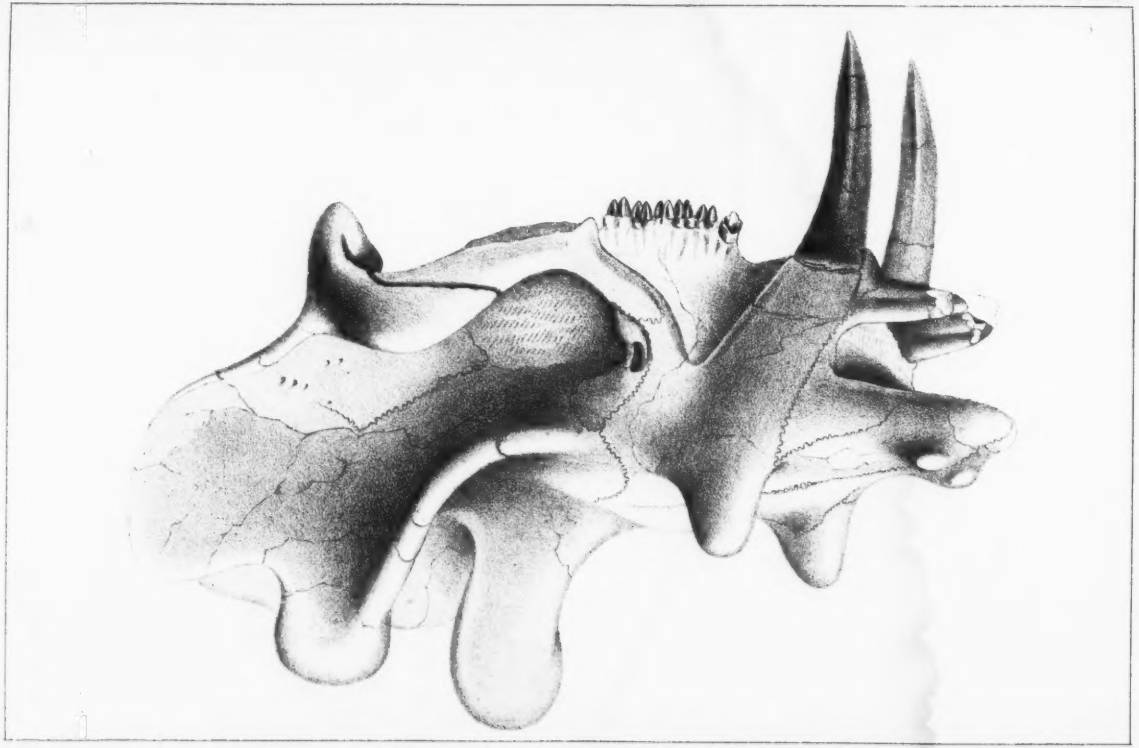
The remains on which this description is based were found in the Eocene deposits of Wyoming, and are now in the Museum of Yale College. A more complete description, with full illustrations, is in course of preparation.

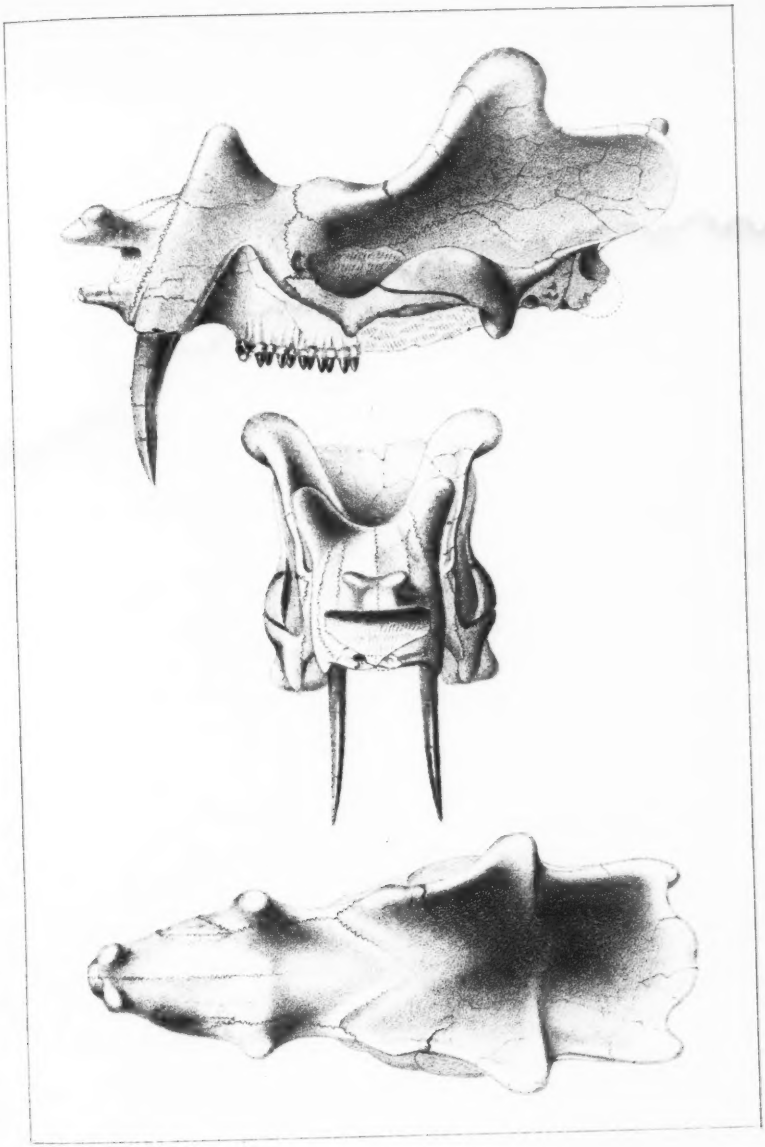
In addition to the descriptions mentioned above, Prof. Cope has since proposed the generic name *Eobasileus*,* and indicated three species, which apparently are not distinct from those previously described by Dr. Leidy and the writer. One of the species named by Prof. Cope (*Eobasileus furcatus*) is based on what he regards as portions of the nasal bones. The description however, indi-

*It is uncertain what date should be assigned to the name *Eobasileus*, and the species included under it by Professor Cope. After a very careful investigation, I cannot ascertain that the descriptions were published before Oct. 29th, 1872, when copies were first received by the Philadelphia Academy of Natural Science, of which Prof. Cope is secretary. The dates on the papers (Aug. 20th and 22d, 1872) certainly do not represent those of actual publication. The descriptions have just appeared (Feb. 6th, 1873) in the "Proceedings of the American Philosophical Society," Vol. XII, p. 485, 487. Several other papers by Professor Cope on fossil vertebrates from Wyoming bear various dates from July 11th to October 12th, 1872, but apparently none of them were published before October 29th, and some of them certainly not until about a month later. As now published in this number of the Proceedings, no less than seven of Prof. Cope's papers are antedated, as the records of the society will show.

cates that these specimens are the posterior horn-cores of other species. Many of the characters given by Prof. Cope in his description of these animals do not indeed apply to the other known species, but it is evident he has made several serious mistakes in his observations. He has likewise been especially unfortunate in attributing to the *Dinocerata* characters which they do not possess; and hence his conclusion, that all these animals are true *Proboscidea*, and possessed a proboscis, is quite erroneous.* In his references and dates, also, Professor Cope has shown the same inaccuracy that has marred his scientific work. It is important, therefore, that his mistakes on these subjects should be promptly corrected, especially such errors as the following: What Prof. Cope has called the incisors are canines, and hence his statement that there are large incisor tusks, but no canines, should be reversed. 2d, the stout horns he described are not on the frontals, but on the maxillaries. 3d, The orbit is not below these horns, but behind them. 4th, The occiput is not vertical, but oblique, the occipital crest projecting behind the condyles. 5th, The temporal fossæ are not small posteriorly. 6th, The great trochanter of the femur is recurved, although Professor Cope says not. 7th, The spine of the tibia is not obtuse, but wanting. 8th, The nasal bones in the *Dinocerata* are not exceedingly short, but much elongated. 9th, The malar bone does not form the middle element of the zygomatic arch, but the anterior, as in the tapir. 10th, The frontals do not have a great prolongation forward, and it is very doubtful if they support horns or processes at both extremities. 11th, The nasal bones are not deeply excavated at their extremities. 12th, The genus *Dinoceras* was not originally referred to the Perissodactyls, but to a new order. 13th, The type species of this order was not described as *Titanotherium anceps*, but as *Titanotherium? anceps*, a difference of importance, as the reference was merely provisional, and the characters given pointed, not to the Perissodactyls, but to Proboscidians. 14th, The date given to *Eobasileus* (August 20th, 1872) is not correct, as stated on page 151. 15th, The name *Tinoceras* was not first proposed August 24th, 1872, but August 19th, 1872, and on that day I mailed Professor Cope the pamphlet containing it. 16th, The communication I made on this subject before the American Philosophical Society was not December 30th, 1872, but December 20th,

* Proceedings Philadelphia Academy, Jan. 14, 1873.





1872, Professor Cope being present. The assertion that it is "exceedingly probable that the tusk of the mastodon and elephant, regarded as an incisor by Cuvier, is really a canine," needs no refutation. If Professor Cope will examine the skull of a young elephant, he will probably find that Cuvier was right after all.

These specific points against his work, Professor Cope has not answered. He has, however, endeavored to break the force of my criticism by a general denial, which evades the main issue between us. He says, in substance, that one species of *Eobasileus*, or rather, one of the five individuals on which this species was based, is different from one of my species. This, however, if established, would not materially diminish the list of his errors on this subject. Professor Cope distinctly included in his group of supposed *Proboscidians* the genera *Dinoceras* and *Uintatherium*, thus mistaking, as I have already shown, both their characters and affinities. Prof. Cope states, moreover, that I have not seen his *Eobasileus*. This is true; nevertheless, I will venture, with due diffidence, to express my belief that he is mistaken in regard to several important characters of this genus; and I have a suspicion that, when carefully studied, it will turn out an orthodox member of the *Dinocerata*, and, not unlikely, a near relative of *Tinoceras*.

Professor Cope reasserts, likewise, that the descriptions he has given are correct. This, however, is impossible; unless, indeed, this mythical *Eobasileus*, under the Professor's domestication, has changed its characters more rapidly than Darwin himself ever imagined for the most protean of species. Professor Cope has stated distinctly that this genus had upper incisors, but no canines; next, that it had canines, but no incisors; and finally, that it has one incisor and one canine. He has said, also, that the nasal bones were greatly elongated; and again, that they were very short; that the spine of the tibia was obtuse; and next that it was wanting. Strangest of all, he informs us that the frontal sinuses of *Eobasileus* are in the squamosal region, and that the premaxillary is a trenchant tusk! Surely, such an animal belongs in the Arabian Nights and not in the records of modern science.—*Yale College, Feb.* 15, 1873.

EXPLANATION OF PLATES.

Plate I. *Dinoceras mirabilis* Marsh. Oblique view. One-fifth natural size.

Plate II. *Dinoceras mirabilis* Marsh. Figure 1, side view; figure 2, front view; figure 3, top view. All one-eighth natural size.

NOTES ON THE VEGETATION OF THE LOWER WABASH VALLEY.

BY ROBERT RIDGWAY.

III. — THE WOODS AND PRAIRIES OF THE UPLAND PORTIONS.

The woods which extend back from the river bluffs toward the prairies are decidedly different in their character from those of the alluvial bottoms. The trees are of a lighter growth, though the timber is by no means small, and the species are fewer in number, while three or four kinds usually prevail largely over the others. The predominating trees are several species of oaks (*Quercus*) and hickories (*Carya*), the species of which vary according to the locality. The aspect of the undergrowth is yet more different, lacking entirely that rankness which the herbaceous plants attain in the bottom-lands, while it is more scant, and perhaps less varied. It often consists of merely a younger growth of the same species as the larger trees, this mixed with patches of hazel (*Corylus Americana*) and, more or less generally, with thickets of wild plum (*Prunus Americana*) and crab apple (*Pyrus coronaria*); the most conspicuous and prevalent herbaceous plants being the May apple (*Podophyllum peltatum*), Columbo (*Frasera Carolinensis*), and Indian turnip (*Arisæma triphyllum*). These, of course, are associated with a vast multitude of other plants, many of them equally striking, and often locally as prevalent, but they vary so much with the locality that we will not attempt to name them here. The comparative thinness of the undergrowth of these woods is easily explained by the dryness of the soil, which is owing both to its higher location and the different geological formation upon which it rests. In consequence of this, the ground is covered throughout the year with a deep deposit of dead leaves, which effectually suppresses the growth of a rank herbage. In the bottom-lands, on the contrary, the ground is continually wet, so that the fallen leaves rapidly decay, while their moist decomposition generates a heat peculiarly favorable to the very luxuriant growth of the herbaceous plants. The vines of these dry woods are, however, not less beautiful and luxuriant than those of the bottom-lands, for, with the exception of *Tecoma radicans*, *Bignonia*

capreolata, and several species of *Smilax*, which are usually absent here, they are of the same species; while the hop (*Humulus lupulus*), wild yam (*Dioscorea villosa*) and climbing rose (*Rosa setigera*), are decidedly characteristic of the dry woods.

The "Oak Openings" are a beautiful modification of these woods, and form a feature strikingly characteristic of the prairie regions of the Mississippi Valley; and nowhere are they more attractive than in southern Illinois. They are usually found in the region where the timber and prairie meet. Their most striking peculiarity is the symmetrical shape, uniform size and compact foliage, of the prairie oaks (different species, according to the locality, but usually the *Quercus imbricaria*, *Q. nigra* or, in damp situations, *Q. palustris*), which, almost exclusively, compose them, and especially the smoothness and fresh appearance of the clean, bright green sward beneath them. To do them justice, we cannot do better than quote from a very truthful description which we have lately read: — "They (the trees) rise from a grassy turf seldom encumbered with brushwood, but not unfrequently broken by jungles of rich and gaudy flowering plants, and of dwarf sumac. Among the oak openings you find some of the most lovely landscapes of the West, and travel for miles and miles through varied park scenery of natural growth, with all the diversity of gently swelling hill and dale; here, trees grouped or standing single — and there, arranged in long avenues, as if laid out by human hands, with slips of open meadow between them. Sometimes the openings are interrupted with numerous clear lakes, and with this addition become enchantingly beautiful." [Encyclopædia of Geography; Thos. E. Bradford, III, 562; 1840.] To this description, we can only add that when viewed from across a meadow, the groves present a symmetry in the trees, a uniformity in their size and shape, and a compactness and richness of foliage, never excelled, and seldom, if ever, equalled, in the best-kept artificial park. The lower branches of all the trees begin at a uniform level, and the space beneath is left perfectly free from brushwood or rubbish of any kind, so that under the straight line marking the lower limit of the foliage, there is seen only the well-shapen trunks, rising from a beautiful sward of the freshest green. The trees about the border are often beautifully canopied by a matted covering of wild grape, while the vines of this species, coiled or twisted into fantastic and artistic shapes, sometimes lend an additional beauty to the groves themselves.

The "Barrens" are sections covered with a scrubby wood of small but growing trees, their growth choked with a nearly impenetrable jungle of varied shrubbery. Comparatively few years ago they were all open grassy prairie, but as soon as the country became settled the young trees began to sprout up, until gradually they have become entirely clothed with thick young forest. Twenty years from now, they will have lost their present character, and become transformed into the usual woods of the region.*

Many former prairies of often ten miles or more in breadth are now entirely overgrown with a dense scrub of hazel (*Corylus Americana*), sumac (*Rhus*—several species), blackberry (*Rubus villosus*), wild plum (*Prunus Americana* and *P. chicasa?*), crab apple (*Pyrus coronaria*) "queen of the prairie" (*Spiræa lobata*), wild roses (*Rosa Carolina* and *R. setigera*) and other kindred shrubs, or small trees, among which spring up a more scattered growth of forest-trees, chiefly oaks (as the *Q. obtusiloba*, *Q. nigra*, and a variety of *Q. falcata*) and hickories. For floral display, no sections of the country are so beautiful as the "barrens." The crimson cones of the sumacs; the showy climbing rose (*Rosa setigera*), which ascends through the trees to their very tops; numerous flowering vines, among which the Leguminosæ and Caprifoliaceæ contribute each a variety of species; and the host of gaudy-flowered plants belonging to the Compositæ, which still linger as remnants of the prairie vegetation, produce not only a gaudy, but also a richly varied appearance, which is still further beautified by the lovely vine-canopies with which many of the trees are clothed.

The prairies which adjoin the forest region of the Wabash Valley are mostly of limited extent, being mere indentations into the timber, or "bays," of the larger ones toward the middle of the State. Most of them have now lost their primitive aspect, being either largely under cultivation or else trampled by herds of stock. According to the settlers it is now a rare, if a possible, thing, to find a prairie where the grass is as tall, the weeds as rank and coarse, and the flowers as showy, as they were twenty or thirty years ago. As they now are, a conspicuous feature in their flora is

* It is asserted by all the old settlers of the country, that there is now a far greater area of timber in this section than there was twenty, thirty, or even forty years ago, notwithstanding the fact that the timber is constantly cut for fencing, building and other purposes to which civilization sacrifices the forests. The encroachment of the woods upon the prairies goes rapidly and steadily on, and seems to supply new timber faster than the old is destroyed.

the frequent clumps of the *Hibiscus grandiflorus*, or great-flowered mallow, which grows along the banks of streams, the border of ponds, or other moist places. This plant occurs more or less abundantly on nearly all the prairies of Richland, Lawrence, Wabash and Edwards counties, and perhaps throughout the state south of latitude 38° 25′. It is one of the most conspicuous plants of the prairie, for when in bloom, its large, crimson-centred white flowers sometimes measure nearly a foot in expanse.

THE GIGANTIC MAMMALS OF THE GENUS EOBASILEUS.*

BY PROFESSOR E. D. COPE.

A genus closely allied to the Proboscidea called Bathmodon, was recently (February, 1872) described by the writer as represented by remains of the Eocene Formations of Wyoming Territory. Investigations prosecuted during the present season, in the same region, under the direction of Prof. F. V. Hayden's Geological Survey of the territories, have resulted in a better acquaintance with these forms, and an approximation to a true estimate of their affinities.

The present genus, which is new and may be called *Eobasileus*,† is proven to be quite distinct from *Bathmodon* in the dentition of the premaxillary bone. It is narrow and edentulous and separated from its fellow by a deep notch. The front of the maxillary bone supports a tusk which represents the canine. It is shorter than in the walrus, but longer than in the sabre toothed tigers, and resembles the canines of the latter in being compressed and sharp-edged in front and behind. A long edentulous space follows the canine, before the molars commence. These are of relatively small size, and number 4 – 2. They all exhibit a single crescentic crest with angle inwards; but becoming straighter on the anterior teeth, where they are little curved. There is a single tubercle within the crescent, which with wearing soon becomes

* Read at the Dubuque Meeting of the American Association for the Advancement of Science. 1872.

† Proceedings of the American Philosophical Society, 1872, p. 485 (August 20).

confluent with the crescent giving a V-shaped surface on the premolars, or later a triangular one.

The general form of the cranium is remarkable. The temporal fossæ are latero-posterior, and there is a transverse supraoccipital crest. The zygomatic arches are posterior and the orbits not enclosed behind, nor with marked superciliary ridges. The muzzle is compressed and roof-shaped, and the frontal bones extend far in advance of the tusks, and even beyond the extremity of the long premaxillaries, overhanging them still more than in the rhinoceros. The margins of their extremities are flared upwards forming bony projections like shovels. These may have supported dermal horns as in the rhinoceros. These are composed externally of the maxillary, and internally of the nasal bones. Add to these, horns with stout osseous cores, one above each orbit, with approximated bases, and the curious physiognomy of the form becomes apparent.

The general form is massive, the ilia are wide and capacious and the limb bones exceedingly stout. The great trochanter is flat and thick; the fibular condyle well developed, and the astragalus little convex. The tarsus and foot are Proboscidian in character, and the short thick phalanges indicate the massive foot of a land animal.

There are three species of this genus known to the writer. The *E. cornutus* is known from many parts of the skeleton, including a nearly perfect cranium. This cranium measures over three feet in length and is in very perfect condition. The tusk is projected about a foot from its projecting alveolus and is recurved and covered on the distal half with smooth enamel. The horn-cores are a foot long, very stout, trihedral at base and with an enlargement on the inner side. The nasal projections viewed from above give the end of the muzzle a bilobed outline. The diameter of the pelvis measured between the crests of the ilia is nearly five feet. The long diameter of the proximal end of the femur is about ten inches. A sacral vertebral centrum is five inches in transverse diameter.

A second species is represented by some portions of the frontal bones. In this one the elevated margin is prolonged into a spatuliform process with a flattened convex extremity. The muzzle of this species when viewed from above is therefore bifurcate, hence the species is called *Eobasileus furcatus*.

A species different from the *E. cornutus* is represented by numerous remains. The most characteristic are the horn-cores, which are compressed at the base, somewhat acuminate and without inner enlargement. This may be called *E. pressicornis*.

The general form was stout and heavy, and less elevated than in the existing elephants. With proportions somewhat as in the rhinoceros, the species *E. cornutus* was larger than in any known species of that genus, being quite equal to the mastodons in bulk.

This form will probably be found to be the predecessor in time of the huge forms of Proboscidians now known, and certain allies will be found to stand in the same relation to the odd and even-toed ungulates.

Remains of six of these huge quadrupeds were found in one locality in Southern Wyoming, and bones of at least twenty were found by the expedition.

Since the above was read at Dubuque it has been ascertained that the *E. pressicornis* and *E. furcatus* belong to the genus *Uintatherium*, having rudimental knobs instead of flat shovels on the nasal bones. This genus differs from *Eobasileus* in the rudimental character of the nasal horn-cores, and in the presence of an elevated lateral parietal crest. In *Eobasileus* the latter is almost wanting. They also differ in the character of the posterior (third) pair of horn-cores.

Subsequently, at a meeting of the Philadelphia Academy of Natural Sciences (January 14, 1873), the writer gave his reasons for regarding the genera *Eobasileus* and *Uintatherium* as Proboscidians constituting a peculiar family of the order, and his objections to referring them to a new order as has been proposed by Professor Marsh. He said he had first (August 20, 1872) *given reasons* for regarding them as *Proboscidea*, though Professor Marsh had previously referred one of them to *Mastodon* by name only. Some of the reasons are as follows:

1. The extreme shortness of the free extremity of the nasal bones.
2. The malar bone is rod-like, and forms the middle element of the zygomatic arch.
3. The cervical vertebræ are exceedingly short and transverse.
4. The radius crosses the ulna obliquely and leaves a large carpal surface to the latter beside it.
5. The femur is without third trochanter or fossa for the round ligament.
6. Its condyles are contracted and the intercondylar fossa is prolonged and fissure like.
7. The spine of the tibia is absent, and the glenoid cavities separated by a longitudinal keel.
8. The astragalus is not hour-glass shaped above, but with a uniform face.

9. The calcaneum is very short and largely inferior.
10. The phalanges represent several toes, and are very short and stout.

To these may be added three external characters, which directly result from the osteological, namely:

11. The possession of a proboscis. This is proven by the extreme shortness and stoutness of the free part of the nasal bones; by the very short cervical vertebræ, and by the fact that the nasal and premaxillary bones are deeply excavated at their extremities, with surrounding osseous eminences, for the origin of the muscles of the trunk.
12. The extension of the femur below the body, so that the leg was extended with the knee below and free from the body, as in elephants, monkeys and man.
13. The short subplantigrade foot, so different from the digitigrade character of other ungulates. The inferior surface of the calcaneum looks as though it furnished insertion for a ligamentous pad.

Other characters, common to *Proboscidea* and some other ungulates, are —

14. The scapula acuminate in outline above the spine, with a very short coracoid and alate spine.
15. Broad truncate occiput with widely separated temporal fossæ.
16. The greatly expanded iliac bones.

The presence of canine teeth and horns had been stated by Professor Marsh as characteristic of a new order. Neither of these were regarded by Professor Cope as sufficiently important for such an interpretation, since in Artiodactyles, and even in the Ruminant division, we have every variety of condition in both these points; *Moschidæ*, *Cephalophus* and *Hydropotes* were hornless, and some of these and some deer had canines. The wart hog has compound molars, no lower incisors and huge tusks. But the difference in this point from elephants he thought would disappear if, as was probable, the tusks of elephants should prove to be canines and not incisors. In these animals, as in *Eobasileus*, the tusk is enclosed between the maxillary and premaxillary, which is not the case with the outer incisors.

REVIEWS AND BOOK NOTICES.

THE GEOLOGY OF THE SEA BOTTOM.*—This is a very important contribution to the study of the bottom of the seas which is now receiving so much attention. Intended at first to be limited to an examination of the sea bottom of the French coast, it was gradually

*A. Delesse. Lithologie des Mers de France et des Mers principales du globe. Paris. Dec., 1871. 2 vols. 8vo. pp. 479; 135: 3 pls., folio with cuts in text.

extended as far as the materials were accessible, such as the results of the deep sea soundings made by the Hydrographic bureaux of the European and American governments, to the principal seas of the globe. It is of course more complete for the seas bordering on France, yet it is a fair beginning of a subject which hitherto has received but little attention. The author has treated his materials with great success and has sketched out the broad outlines of a most fruitful line of inquiry.

It is the first systematic attempt made to classify the deposits now going on owing to the agencies at work on the surface of our earth; to show how unequally the deposits are made, how greatly the nature of these deposits and the existing topography are modified by the direction of the prevailing winds and oceanic currents, and more especially how materially the geology of the shores of the river basins, and of submerged rocks subject to the action of the waves, influences the mineralogical constituents of the deposits formed at any one point.

The maps which accompany this volume are the results of the most careful examination and analysis of the materials brought up by the lead, or thrown on the shores by the action of the waves, or resulting from the decomposition of the cliffs along the coast line, of the banks of the rivers forming the different hydrographic basins, from their source as they pass through the different geological formations to their mouth. The fate of the different mineralogical constituents is carefully followed and the effect each has upon the bottom of the sea into which the basin drains carefully noted.

The effect of the atmosphere in carrying dust in suspension, of the direction of the prevailing winds, especially on the seacoasts leading to the formation of dunes, and the effect produced by the unequal distribution of rain as an erosive agent in the different hydrographic basins are very accurately considered. The amount of material held in solution and suspension in the rivers of France is shown to be enormous and to depend of course mainly upon the geological composition of the rocks of the different hydrographic basins influencing, to a great extent, the condition of the navigation of the outlets of the larger rivers, and the formation and preservation of the harbors at the mouth of the navigable rivers. The power of transportation and erosion of fresh water and rain, as shown by the action of rivers, is slight compared to the action of the sea; the mechanical results produced by waves, by permanent

currents, by the tides and prevailing winds, are more varied of course than those of the rivers. The action of the sea extends over a great area and acting at a great depth is the most powerful agent in the rearrangement and final distribution of the materials brought down by the rivers.

The action of internal agents produced by eruptions, though undoubtedly very powerful, is unfortunately inaccessible and we can only guess at what might happen from a study of such phenomena as the submarine volcanoes of the Mediterranean, the Caspian sea, and remember that many of the phenomena which produce instant visible changes on the surface of the globe must be acting with equal or greater efficiency and as frequently on the bottom of the sea.

The agency of organisms in determining the constitutions of the bottom of the sea is only introduced as far as the action of the invertebrates of the coast of France can throw any light upon the subject, and no attempt has been made by the author to do more than point out, what is well known to all students of marine zoology, the correlation between the fauna and the physical structure of the coast. He indicates the dependence of special forms or certain floras upon a sandy or rocky bottom, or a gravelly shore, or the different features presented by a muddy shore. This is perhaps the most unsatisfactory part of the work, and it is a great pity that the description of the agency of animal life upon the formation of the sea bottom should have been limited to the comparatively uninfluential agencies at work at the present time on the coast of France, and that only slight allusion should have been made to the all-important part which corals now play in the fashioning of the sea bottom of so large a part of our globe.

The maps are admirably engraved and as far as they relate to France and Europe of great accuracy. A few unfortunate errors have crept in relating to the hydrography of the Hudson and Susquehanna rivers and the connection of the great Lakes, which are undoubtedly due to the want of supervision of a part of the work during the Prusso-French war. The map of the hydrographic basins of France is especially worthy of notice. He has completed the survey of the seas of the present time by a very successful attempt to restore and map out the ancient seas and general topography of France during the successive geological periods, and to give a succinct history of the changes which have

taken place to bring about the present topographical features of France.

The data from which the conclusions of Delesse have been drawn are carefully tabulated and published as an independent appendix to the general text. This work was nearly completed at the breaking out of the war, and the unavoidable delay occasioned will account for the absence of reference to much that has been done of late by the Scandinavian, American and English governments.

These matters of omissions are of slight importance, and we recommend this suggestive volume to all who are interested in the study of geology as deduced from agencies now at work on the surface of our globe.—A. Agassiz.

Handbook of British Birds.*—Justly observing, of several admirable works on British Ornithology, that "they do not distinguish with sufficient clearness the species which are truly indigenous to Great Britain from those which are but rare and accidental visitants; nor do they indicate with sufficient authority the scientific nomenclature which should be adopted"— the author undertakes to supply these deficiencies in a Handbook which is not "intended to rival or supplant existing or forthcoming textbooks on the subject, but to assist students in a manner and to an extent which has not been contemplated in the works referred to." "The claims of species to rank as British, the proper scientific names which each should bear, the *habitat* of the rarer visitants, and the frequency or otherwise of their occurrence are points to which attention is almost exclusively directed." The author has thus had a definite plan of work, which has been unquestionably executed with fidelity and ability; and though we are not prepared to judge the accuracy of his statements in detail, we should say that they show intrinsic evidences of reliability, both from the author's evident familiarity with his theme, and from the obvious care with which he has compiled and digested the statistics of those observations which, in the nature of the case, he cannot have personally made or verified.

Following an introduction which contains much miscellaneous information besides a comprehensive survey of the matter in hand, comes a freely annotated list of the residents, migrants and annual

* A Handbook of British Birds showing the distribution of the resident and migratory species in the British Islands, with an Index to the Records of the Rarer Visitants. By J. E. Harting, F.L.S., F.Z.S., etc. etc. London. 1872. 8vo. pp. xxiv, 198.

visitants, with concise and precise statement of the part each plays in the bird fauna. These classes are found to embrace two hundred and sixty species, out of a total of three hundred and ninety-five recognized as British; the remaining one hundred and thirty-five, or rather more than one-third, being considered as "rare or accidental visitants." To these last, Part II of the work, no inconsiderable portion of the whole, is devoted, and we particularly admire the way these stragglers are handled. While the author is lavish of references throughout the work, citing his authority as a rule for all special occurrences, this portion of the volume is almost entirely composed of references to recorded cases of capture or observance of the species noted. For instance, twenty-four observed occurrences of the snowy owl are noted, each accompanied by a citation of the published record. Another portion of the work gives a nominal list of British birds, in which the indigenous species and the stragglers are printed in parallel columns. We do not see how more information of the sort that the author volunteers to supply could be brought within the same compass, nor what more convenient, and consequently useful, method could have been devised for holding up the whole subject in the strongest light.

For ourselves, we are naturally most interested in the cases of those North American birds which enter the list as stragglers.* The author enumerates over forty of them, a few however with doubt. "It is extremely difficult to believe," he continues, "that the non-aquatic species in this list have journeyed across the

* Following is the list, which some one without Dr. Harting's book at hand may find useful. The numbers in parentheses indicate the instances of observation or capture. —*Astur atricapillus* (3), *Nauclerus furcatus* (5), *Buteo lineatus* (1, doubtfully), *Scops asio* (2, doubtfully), *Nyctale Acadica* (0, doubtfully), *Vireosylvia olivacea* (1), *Regulus calendula* (1), *Anthus Ludovicianus* (9, doubtfully), *Loxia leucoptera* (4), *Agelaus phœniceus* (9), *Sturnella magna* (3), *Picus villosus* (2), *P. pubescens* (1), *P. auratus* (1), *Cuculus Americanus* (5), *C. erythrophthalmus* (1), *Ceryle alcyon* (2), *Hirundo purpurea* (2, doubtfully), *H. bicolor* (1), *Columba migratoria* (5), *Ortyx Virginianus* (introduced), *Ægialitis vociferus*, *Totanus flavipes* [each ?] (3), *T. solitarius* (1), *Actiturus Bartramius* (4), *Tryngites rufescens* (15), *Tringoides macularius* (16), *Tringa maculata* (16), *T. Bonapartii* (9), *T. pusilla* [of Wilson] (2), *Gallinago Wilsoni* (1), *Macrohamphus griseus* (15), *Numenius borealis* (4), *Botaurus lentiginosus* (4), *Crex Carolina* (1), *Cygnus Americanus* (1), *C. buccinator* (1), *Anser albatus* (1), *Anas Americana* (6), *Clangula al'eola* (5 or 6), *Œdemia perspicillata* (10), *Somateria spectabilis* (15), and *Mergus cucullatus* (11).

We wish that some of the continental quotations of American birds, notably those referring to Heligoland could be scrutinized as closely as Dr. Harting has the British ones.

It is an interesting question what proportion the *recorded* occurrences probably bear to the *actual* number of such instances of American stragglers.

Atlantic, and performed a voyage of at least seventeen hundred nautical miles on the shortest route, *via* Newfoundland; but that most of them have actually done so seems proved by the fact that they have never been met with in Greenland, Iceland, and the Faroe Isles, and many which have thus found their way to England or Ireland. . . have never been met with on any part of the European continent. As might be expected, at least half the American species found in this country belong to the orders *Grallatores* and *Natatores*, while of the fourteen species of Insessorial birds, none of them, with the exception of *Agelæus phœniceus*, has occurred half a dozen times. This plainly shows that their appearance on this side of the Atlantic is the merest accident and not the result of any continued and successful attempt at migration (p. xi)." In taking account of these and other straggiers, Dr. Harting makes some further remarks which are timely and judicious on the credibility of published records. While we speak in unqualified terms of the success we believe Dr. Harting has attained in all that relates to the principal one of his two aims, just noticed, we think it remains to be seen whether he has fixed the nomenclature of even the comparatively few species he treats, more stably than his predecessors in the same field. The plain truth is, we are all at sea now in this matter; for the simple reason that we may advise, or exhort, or even "legislate," yet have no means of making others mind what we say. A law is no law that binds only those who choose to be bound. If it be urged, that in such case an appeal to good sense should suffice, it might be replied (borrowing a simile from our author), that good sense is a "rare and accidental visitant" of average humanity, by no means "indigenous" even to ornithologists; and consequently can seldom be invoked with reasonable expectation of any tangible result.—E. C.

The Birds of Florida.— The first part (4to, pp. 32) of Mr. C. J. Maynard's work, the "Birds of Florida," having come to hand, we are enabled to judge somewhat better of its scope and general character than we were able from the specimen pages sent out some time since with the prospectus. Fifteen species are described, carrying us through the families *Turdidæ*, *Saxicolidæ*, *Sylviidæ*, and nearly through the *Paridæ*. Though nominally a work on the birds of Florida, it embraces many biographical and other details based upon observations made in New England, thus giving quite

a full history of each species, instead of merely a sketch of its characteristics as seen in the "Land of flowers." This method will, of course, increase the value of the work to the general reader. The title* quite fully indicates its general character, as far as the more technical part is concerned, but the "notes on their habits" are really very satisfactory and concise biographical sketches, written in an exceedingly clear and pleasing style. With them are incidentally incorporated, as occasion offers, graphic and more or less extended delineations of the peculiar natural features of the country — of the Pine Barrens, the Everglades and the Keys. The matter is arranged under distinct heads, and the biographical part is further distinguished from the rest by being printed in larger type. The descriptions are well drawn, and unusual attention is paid to the different states of plumage depending upon age and sex. The work is thoroughly original, and almost every page contains some interesting fact relating to habits or particular phases of plumage not previously chronicled. The dimensions given are usually the average of a considerable series of specimens. While not wholly above criticism in respect to a few minor points, the work is not only an attractive one but a valuable contribution to ornithological literature. Its typographical execution is exceedingly neat, and the plates, judging from the specimen number, are very creditable productions.—J. A. A.

THE SCIOPTICON MANUAL.†—The appearance of a new and revised edition of this book gives occasion to say that both it and the apparatus which it describes will be found of great service to those who are desirous of illustrating optically (by diagrams, pictures and experiments) their scientific teaching, but who are shut off by their limited means from the purchase of the more expensive calcium and electric lanterns. For a class room or school laboratory, Mr. Marcy's Sciopticon will supply an excellent means of demonstration. It is likely that the use of the modern demonstrating lantern will continually increase the very brilliant results attained by Profs. Morton and Tyndall, being quite sufficient to

* The Birds of Florida, containing Original Descriptions of upwards of Two Hundred and Fifty Species, with Notes on their Habits, etc. By C. J. Maynard. With Five Plates, drawn and colored from Nature, by Helen S. Farley. Salem, Naturalists' Agency, 1872. Part I. 4to, pp. 32, and one plate. October, 1872.

† The Sciopticon Manual: explaining Marcy's New Magic Lantern and Light, including Magic Lantern Optics, Experiments, Photographing and Coloring Slides, etc., by L. J. Marcy, optician, 1340 Chestnut St., Philadelphia. Revised ed., 1872. Price 50 cents.

excite enthusiasm among all educators and lecturers. Mr. Marcy seems to have done the best that can be accomplished with coal oil as a source of light; and he constructs a very powerful lamp for this purpose, with this especial merit in its plan, that it has no chimney to be broken otherwise to annoy the operator. Besides the description and figures of the Sciopticon, the manual contains very full direction for experimenting, photographing and otherwise preparing slides, etc. One chapter is contributed by Prof. Henry Morton, the most successful American demonstrator and experimenter with the lantern.— E. C. B.

BOTANY.

The Horse Disease. — Referring to the communication in the February number (pp. 120–123), as Mr. Morehouse found that many of the organisms he represents were present in the air of the stable, he should now, when the disease has passed, as soon as possible expose similar glass slides to the same conditions, — so as to ascertain whether these organisms are not still there. Upon the result of this the whole importance of the observations depends.

While the pen is in hand, we beg to dissent from the idea that lichens are parasitic and have no chlorophyl (p. 67); and no less from the statement that the "plants are very few" which require the aid of insects to secure fertilization, and which attract them by their bright colors; and that most flowers could accomplish their destined purpose just as well were they clad in the drab of the veriest Quaker (p. 70). The young people who read "How Plants Behave" will know better. — A. G.

The Cretaceous Flora of North Greenland. — Among the interesting collections which the Swedish polar expedition of 1870 brought to Europe was a fine suite of fossil plants, collected at the desire of Dr. O. Heer, in Zürich, who in his "Flora Fossilis Arctica" proved that certain black shales at Kome, north of the peninsula Noursoak, belonged to the Cretaceous series. This is now conclusively proved. The specimens brought from Kome are forty-three in number, among which Dr. Heer recognizes *Filices*, *Rhizocarpeæ*, *Equisetaceæ*, *Cycadeæ*, *Coniferæ*, *Monocotyledones*, and *Dicotyledones*. The Ferns are very numerous, *Gleichenia* being peculiarly abundant. The *Cycadeæ* and *Coniferæ* are also repre-

sented by many species, among which *Podozamites Hoheneggeri* is notable, as likewise occurring in the Wernsdorf beds of the Northern Carpathians. Monocotyledons are rare, and only exist as fragments in the collection, while the Dicotyledons also are only represented by a few fragments of leaves, most probably belonging to *Populus*. Such a flora, with a preponderance of *Coniferæ*, *Cycadeæ*, and *Filices*, and *Gleichenia*, *Marattiaceæ*, *Dictophyllum*, and *Cycadeæ* in abundance, must be counted a subtropical one. To judge from the presence of *Podozamites Hoheneggeri*, and *Eolirion primigenium*, the deposit probably represents the Wernsdorf beds belonging to the Urgonien. This flora has a different climatic character from the Miocene flora of Greenland, in which respect it agrees with the Lower Cretaceous flora of Central Germany. Similar black shales have also been found at the south side of the Noursoak peninsula, near Atane, and at about eight hundred feet below the well-known Miocene bed. Here also the shales contain plants belonging to a higher horizon of the Cretaceous series. There are forty-five species known; among them being *Filices*, *Cycadeæ*, *Coniferæ*, *Monocotyledones*, and *Dicotyledones*. *Coniferæ* are again numerous, but Ferns are rare. Of *Monocotyledones* only a *Bambusium* and two other species are known. The difference between the Atane beds and those of Kome chiefly consists in the great preponderance of *Dicotyledones* in the latter, which, as in the Upper Cretaceous of Germany, are presented by great variety of types. A point of great interest is the discovery in these beds of a beautiful species of fig tree with leaves and fruit attached. In Central Europe *Dicotyledones* make their first appearance in the Cenomanien, and are very abundant in the Senonien near Aix-la-Chapelle. It is curious that both in Greenland and in Central Europe the *Dicotyledones* display a great variety of types in the Upper Cretaceous series, but are nearly wanting in the Lower Cretaceous. It seems to point to a great change having taken place in the flora between our latitude and 71° N. after the deposition of the Gault. ("Zeitschrift der deutschen geologischen Gesellschaft," part i, 155.)— *The Academy*.

Cultivated Wheat in a Bone Cave.— "The Bulletin de Académie royale des Sciences de Belgique," No. 7, contains a note by G. Dewalque announcing the discovery of wheat in a bone-cave in Namur. An exploration of this cave, which is near Jemelle,

was made by Professor Cousin, of Louvain, who found some bone implements, together with numbers of human bones. During a later visit more human bones, and a somewhat abundant quantity of wheat, were discovered in a stratum of angular flints. The wheat appeared to have been charred, and though it is decidedly smaller in size than our ordinary grain, the author does not hesitate to affirm that the material he has found is cultivated wheat. — *The Academy.*

ZOOLOGY.

The Spike-horned Muledeer.—My friend Mr. J. A. Allen, in a late number of the Naturalist, calls in question the accuracy of my observation on an animal of the above character, believing that I have been deceived and have mistaken a two year old elk for a buck, *Cariacus macrotis*. Although I did not see the animal in the skin, my informants at Fort Hays were so well assured of its character that I accepted their statements. On a second inquiry of Dr. J. H. Janeway, Post Surgeon, he favored me with the following letter: —

"Fort Hays, Kansas, Nov. 7, 1872.

Prof. E. D. Cope, *Philadelphia, Pa. My dear Sir:*—In regard to the spike-horns that I sent you, of which you so kindly acknowledged the receipt, and which seem to have caused some dispute as to their species: — I informed you that they were from a black tailed deer. Since then I have satisfied myself entirely that I was correct in the assertion. The buck was killed in company with a doe, about three miles southeast of this post and the meat was partaken of by my family and the families of other officers at the post and by patients in the hospital, and was recognized by all to be a "black tail deer." The skin, and especially the tail, were in possession of one of my sons for a long time and were known to him to belong to a black tail deer. No elk has been shot or seen at this post or this side of the Saline (over twelve miles distant, nearest point) inside of five years."

The association with a doe of the black-tailed species adds greatly to the probable correctness of the determination.

I have moreover examined a second example of spike-horn of this species, in possession of Mr. Prentice of Topeka, Kansas. The stuffed head which bears the horns belonged to a deer which was brought to the market in Leavenworth, Kansas, having been killed west of that city, towards the Republican river. The animal is evidently adult. The beam is twenty-two and one-fourth inches in length, fourteen inches in diameter at the base and sep-

arated three inches from its mate, at the base. It is thus not quite so long as the beam of the specimen first described. It differs moreover in possessing a peculiar curvature just beyond the point where the large anterior antler should have been given off (which exceeds the beam in *C. Virginianus*). The true beam is shortly sigmoidally twisted, and then pursues a more anterior direction than in the normal horn, or my spike-horn. The anterior antler is represented by a rudiment.—E. D. Cope.

Does the Pelican feed its young with its own Blood?—The supposed fable of the pelican feeding its young with its own blood may prove, after all, to have some foundation in fact, as a somewhat analogous circumstance has recently been observed in connection with the flamingo. A pair of these birds in the Zoological Gardens of London showed symptons of breeding, but laid no eggs. Some Cariamas, kept in the same aviary, have the habit of opening their mouths, bending back their heads and uttering a plaintive cry like young birds. In response to this, the flamingoes during the period referred to would frequently stand over the Cariamas and, with a gulp, raise up a reddish glutinous fluid from their throats and disgorge it over them, pouring it into their throats and even over their backs. This on examination proved to consist of blood corpuscles, in a glairy fluid, and mixed with crystals, supposed to be principally of salt. This, by Mr. Bartlett, the superintendent of the Gardens, is believed to be an addition to the usual food furnished by the parent flamingoes to their young, and perhaps analogous to the milky fluid supplied by pigeons under the same circumstances, and discharged from the thickened membrane of the crop.

A somewhat analogous, and still more curious, fact is furnished by the hornbill, an African bird with a huge bill, of which many species can be seen in our public museums. As is now known, the male bird is in the habit of walling up the female while seated on her nest in a hole of a tree, so as to imprison her completely, leaving only the head and neck exposed. He then fills his crop with fruit which becomes encased in a gelatinous envelope, secreted from its walls and the whole is then brought up in a mass and fed to the captive.—S. F. B.

Nest, Eggs and Breeding Habits of the Vermilion Flycatcher (*Pyrocephalus rubineus* var. *Mexicanus*).—This bird is a common summer resident of the southern portions of Arizona,

where it arrives the latter part of March, or early in April, almost exclusively frequenting the wooded borders of streams. About the 20th of April the pairs begin to build their nest, which is placed on a fork of one of the smaller branches of a mezquite or cottonwood, usually ten to twenty feet from the ground. It is difficult to find on account of its small size, and is not easily preserved being a very shallow affair, and loosely constructed. One now lying before me is composed of a groundwork of tops of weeds and small dry willow twigs, to which are added a few small pieces of the soft inner bark of cottonwood, and some other plant fibres; the lining consists of fine hair and pigeon feathers. The eggs are usually three in number; at least, I have never found more. They are of a very pale cream color, spotted and blotched with the shades of umber brown and lilac, the spots in most cases forming a ring round the larger end, though sometimes pretty evenly distributed over the whole surface; and in such cases the markings are usually smaller and paler. The dimensions of a set are as follows:—.70 by .51; .69 by .53; .68 by .52. The largest one of four sets measures .72 by .52; the smallest, .66 by. 53. The period of incubation is about two weeks; the male does not appear to take part in it. At least two broods are reared each season. The male is very noisy at this time, hovering in the air in the manner of a sparrow-hawk if he observes any unwelcome intruder near his nest; when much excited resembling a miniature turkey-gobbler, and presenting a comical appearance with his crest erect, every feather ruffled out, and his tail at right angles with his body, seemingly having hard work to keep his balance. Whilst on wing at such times he continually utters a shrill cry of alarm, something like the syllables "*ze-bri, ze-bri*" quickly repeated. On leaving the nest, the young are of a uniform ashy gray color. About the end of September the bird leaves for its winter home in Mexico.—Lt. Chas. Bendire, U. S. A., *Tucson, Arizona.—Communicated by Dr. Coues.*

Distribution of the Helicidæ in the Sandwich Islands.—Mr. John T. Gulick has contributed to a recent number of "Nature," a very interesting and valuable addition to our knowledge of the geographical distribution and variation of species, in an account of the section of Helicidæ, known as Achatinellinæ, found in the Sandwich Islands. The family, of which the com-

mon snail is an example, is quite peculiar to this group of islands, and is characterized by the columella having a spiral twist, giving it the appearance of being armed with a lamellated tooth revolving within the shell. The singular fact is that most of the genera and all the species are restricted, not only to a single island, but to a very small area in the islands. In Oahu, an island sixty miles long and fifteen broad, there is the extraordinary number of one hundred and eighty-five species of Achatinellinæ, none of them (with scarcely an exception) found on any other of the islands and no species occupying a large proportion even of this area. Most of the species are confined to the forests of mountain regions; and where, as on Oahu and Maui, there are two regions of forests divided by several miles of grass country, the island is also divided into two sections, having but few, if any, species in common. On the island of Oahu, the two sections which occupy separate mountain ranges are divided into many minor sections in the following manner. From each side of the main range project mountain ranges, which separate deep valleys a mile or two in width. Each of these valleys is a subordinate section, having its own varieties, and, in many instances its own species, which are nowhere else. Nearly all the species of one genus, found on one mountain range, are connected by varieties presenting very minute gradations of form and color. Species of the same genus on different islands are not so completely connected by intermediate forms. The family is divided into two natural groups of genera. The first group consists of seven genera, — Achatinella, Bulimella, Helicterella, Portulina, Newcombia, Laminella and Auriculella; these are all arboreal in their habits, and are either sinistral, or both dextral and sinistral. The second group consists of three genera, — Amastra, Leptachatina and Carelia; these mostly live on the ground, and are dextral. Granting the hypothesis of evolution, Mr. Gulick is quite unable to account for these singular facts, and many others enumerated in his highly interesting paper, on the theory of the Survival of the Fittest, or any other theory that has yet been brought forward. — A. W. B.

Harlan's Hawk and the Mexican Cormorant. — Prof. Baird having expressed a desire to see the specimens designated in my "Catalogue of the Birds of Kansas" as "Harlan's Hawk" and the "Florida Cormorant," I sent them to him for examination. Mr.

Ridgway writes that "the Buteo is really *B. Harlani* and in a plumage not seen before." A description of this bird will be found in his monograph of the North American Raptores soon to be published. Of the Cormorant, he says that it "is not *Graculus Floridanus* but *G. Mexicanus!* — the first specimen obtained north of the Rio Grande!" This bird was taken four miles south of Lawrence, April 2d, 1872. My mistake in the determination of the species arose from the lack of other specimens with which to make comparison, and from the fact that the measurements of this single specimen exceeded those given in Baird's General Report, the stretch of wings, for instance, being full six inches greater. — FRANK H. SNOW, *Lawrence, Kansas, July* 5th, 1872.

NOTE ON THE DATES OF SOME OF PROFESSOR COPE'S RECENT PAPERS.—The "Proceedings of the American Philosophical Society," vol. xii, No. 89, just issued (February 6, 1873), contain several communications by Professor Cope on Vertebrate Fossils from Wyoming. There are several errors in the dates of these papers, bearing in the same direction as those which I have already pointed out, but fortunately many of these can readily be corrected. In the table of contents of this number, under the stated meeting, August 15, 1872, eight papers by Professor Cope are enumerated; and it might be inferred that they were read on that day. In fact, however, there was no meeting of the Society on the 15th, the regular August meeting having been held Friday, August 16th, at which three only of these papers were read by title, or entered on the records. At the next regular meeting, September 20, 1872, five papers by Professor Cope were announced, or read by title. But as now published in the "Proceedings," four of these purport to have been read September 19, 1872, when no meeting was held on that date. The actual publication of these papers, by distribution, is of course a distinct matter, and the evidence is conclusive that none of them were so published before October 29, 1872, and some of them not until long after.—O. C. MARSH.

THE SOUND PRODUCED BY THE DEATH'S HEAD MOTH.—Mr. H. N. Mosely has been investigating the cause of the peculiar cry produced by the Death's Head Moth, *Acherontia atropos*, and records the result in "Nature." A number of treatises have been written on the subject, from the time of Réaumur in 1734, the various writers attributing it to friction between the abdomen and

thorax, the expiration of air through the proboscis, special organs attached to the abdomen, vibrations of the thoracic rings, and vibrations of the wings in rapid motion. A very complete and ingenious series of experiments conducted by Mr. Mosely seem to place beyond doubt the conclusion that the sound is produced by the proboscis, the note being formed at a narrow slit-like opening at the base of the trunk, and being modified by passage through the proboscis, and by vibrations therein set up. — A. W. B.

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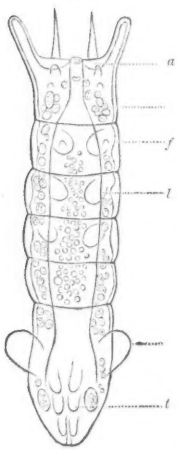

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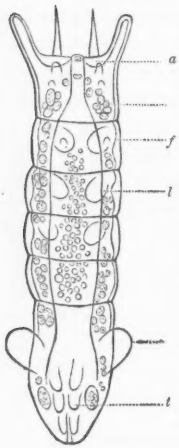

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hovering over them during the day, and towards evening they all collect on the shrubs, or small trees, in groups of from ten to fifty. They will select the leeward side of the tree and alighting upon the leaves hang wings downwards; remaining in this position if undisturbed through the night. They are exceedingly stupid when thus roosting and I have taken as many as thirty with a single sweep of my net. Each group will be composed of a single species, but there are three kinds which usually gather in this manner, viz: — *Danais berenice*, *Agraulis vanillæ* and *Pieris monusta*.

The paths through the scrub are good collecting grounds for the smaller ones (*Thecla*, *Lycæna*, etc.), and I captured many of them. Among these I found a species of Lycæna which I think undescribed. It is of plain color and retiring habit, frequenting the edges of the bushes, generally keeping in the shade of the foliage. On this account I propose to name it the modest Lycæna (*Lycæna modesta*). The following is a description of this butterfly.

Above ashy-brown; darkest on the outer edges of the primaries, and becoming pearly on the secondaries. There are two triangular spots of black on the outer margins of the latter, and indications of a third. These are preceded on the outer edge by a band of black, which is slightly margined with white. Tail black. Under side ashy with a band of nearly confluent spots near the outer edges, which are edged with white on the outer sides. There is a narrow black line on the margin of the wings, preceded by ashy. Between the bar and line there are a few dusky triangles. also a few dusky spots near the costal border. A few black spots edged with white on the secondaries near the body. These are preceded by a bar of partly confluent black spots, margined on the outer side with white. Then come two bars of dusky spots edged with white on the inner side. The wing is terminated with an ashy line, which is preceded by a bar of black, edged on the inner side with white. There is a crescent of red near the middle of the outer side which encloses a black spot. On the lower angle is a black spot preceded with reddish. Body ashy; antennæ black, tipped with reddish-brown. Expands about one inch. — C. J. MAYNARD.

THE RIBBON SEAL OF ALASKA. — This species of seal (*Phoca fasciata* Shaw or *P. equestris* Pallas) is found in the waters of

northern Alaska, and is, so far as known, only represented well in the museum of St. Petersburg. In the Smithsonian collection, there are two skins, obtained by Dr. Dall from Cape Romanzoff, but no skull or other parts of the skeleton. The species is remarkable for color as well as for structural peculiarities. The male is at once recognizable by the color; this may be said to be a chocolate-brown except (1) a band of whitish-yellow, bent forwards towards the crown around the neck (2) an oval ring of the same color on each side, encircling the fore feet, and passing in front just before them, and (3) another band, also bent forwards above, behind the middle of the trunk. There is considerable variation in the extent of these bands, and sometimes the peribrachial rings are more or less confluent with the posterior band. The females are simply whitish-yellow, or have very indistinct traces of the postmedian band (fide Von Schrenck).

The structural (and especially dental) characters of this species, according to Von Schrenck, indicate a generic distinction from all the familiar forms of the subfamily *Phocinæ*. The molars (except the first) are two-rooted as in the typical *Phocinæ*, but in external form are simply conic or have rudimentary cusps, thus resembling Halichœrus. The genus may be named *Histriophoca*.

The special object of this communication is to call the attention of travellers in Alaska to the species, and skeletons (especially skulls) and skins are earnestly asked for. The species has been found also in Kamtschatka, and at the mouth of the Kamtschatka river in March and April, arriving there later than the other seals named.

One of the skins in the Smithsonian collection has been peeled off from the animal almost entire, and by a cross slit below and between the fore feet, and, being tied in front, has evidently been used as a bag. — T. Gill.

GEOLOGY.

Fossil Quadrumana in the Eocene of Wyoming. — An examination of more complete specimens of some of the extinct mammals already described by the writer from the Eocene deposits of the Rocky Mountain region, clearly indicate that among them are several representatives of the lower Quadrumana. Although these remains differ widely from all known forms of that group, their more important characters show that they should be placed with

them. The genera *Limnotherium*, *Thinolestes*, and *Telmatolestes*, especially, have the principal parts of the skeleton much as in some of the Lemurs, the correspondence in many of the larger bones being very close. The anterior part of the lower jaws is similar to that of the Marmosets, but the angle is more produced downward, and much inflected. The teeth are more numerous than in any known Quadrumana. Some of the species have apparently forty teeth, arranged as follows: Incisors $\frac{2}{2}$? canines $\frac{1}{1}$, premolars $\frac{4}{4}$ and molars $\frac{7}{7}$. A full description of these interesting remains, the first of the order detected in this country, will be given by the writer at an early day. — O. C. Marsh, *in the American Journal of Science and Arts, Vol. IV, Nov.*, 1872.

The Eobasileus Again. — I have just received a paper "On the Gigantic Fossil Mammals of the Order Dinocerata, by Prof. O. C. Marsh," which contains a formidable catalogue of errors which the author appears to suppose I have committed in describing animals of this type. All this is explained by the fact that Prof. Marsh has never seen the genus *Eobasileus* Cope, and erroneously supposes it to resemble *Uintatherium* Leidy (*Dinoceras* Marsh.) The descriptions which I have given are correct, as will presently appear, as well as the fact that I have anticipated the Professor in the description of some of the allied species. — E. D. Cope, *January 31st*, 1873.

ANTHROPOLOGY.

Are They Twisting Stones?— Associated with the various forms of stone implements and weapons found upon the surface of the fields in New Jersey are certain flat, quadrangular plates of stone of varying density, having one, two or more holes drilled through them. The outlines of these stone plates vary considerably, as may be seen by the reference to the drawings of seventeen specimens given by Squier and Davis, in "Ancient Monuments of the Mississippi Valley," p. 237, Fig. 136; and the position of the holes will also be seen to vary to a considerable extent. Of the two-holed specimens found by the writer, in the neighborhood of Trenton, N. J., the majority are about six inches in length by one and one-half inches in breadth; and the perforations are in most instances about an inch from either end. Such specimens as these are by many archæologists considered "twisting stones,"

or "for condensing the raw hide or sinews used as bowstrings." We have, however, looked upon them as "breast plates;" using that term not to designate a protective covering, but as an ornament that was suspended by a cord so as to rest upon the breast; or by the perforations, sewed or fastened securely to the skin mantle of the red man.

We have considered this to be the case, because in the "surface" burials—that is, graves originally on the surface, and now but little beneath it—which we have frequently discovered, we have found these perforated stones, of various shapes, lying upon the strip of black mould which once was a human body, *always* in such a position as to show that, whatever the object's use, it was placed upon the breast of the dead man, when the burial took place, or was one of the ornaments about him during life, and so was buried with him; and it seems strange, that if such a stone had been used solely as a "twister," that it should be placed upon the breast, instead of at the feet where the domestic implements are found, or at the right side, where we find the arrowheads, an axe or two, spears, knives and lanceheads.

Very many of these perforated stone relics, too, have but a single hole drilled through them, and being of such small size, and variously outlined, it is no stretch of the imagination to set them down as ornaments for suspension from the nose and ears. These single-holed specimens run into the others, as it were, just as the spear and lancehead are but large arrowpoints. Again, there are other specimens of this class of relics, which have more than two holes, sometimes as many as seven; as though the stone had been drilled again, when coming into the possession of another. At the ends of these many-holed specimens particularly, there is often found a series of well-cut notches, too small and closely set for any special use; but it seems to us very suggestive of a record that the owner of the stone has kept; and if so, the use of the stone as an ornament, worn at the breast, becomes the more probable, the specimen having additional value given it by the record, if such it was, that is engraved upon its margin.

Mr. Evans, in his work, "Ancient Stone Implements of Great Britain," figures, on pages 380-1, specimens allied to those we have described, but having the holes drilled in pairs, at each end. They differ further from the American forms, by being usually "round on one face and hollow on the other;" while as a rule, at least in

New Jersey, they are flat upon each side, with more or less bevelling of the edges.

With reference to the use of these plates, Mr. Evans quotes Rev. Canon Ingram, as suggesting "that these British plates were bracers or guards, to protect the left arm of the wearer against the blow of the string in shooting with the bow." Had this been one of the uses to which some of the American forms had been put, would it not have been retained by the Indians until now? And does any tribe of our aborigines use such a guard when hunting or fighting with the bow? There seems to be much reason, indeed, to believe that these plates were "bracers," in England, and it may be that many of the American forms were used in twisting cord and in condensing sinew; but as we have found so many in graves, in the position we have described, we cannot but think that the vast majority were merely for ornamental purposes. — Charles C. Abbott, M.D.

Collections of Swiss Lacustrine Relics. — The present notice is written for the benefit of gentlemen interested in prehistoric archæology, who may be desirous of acquiring a collection of relics from the ancient lake-dwellings of Switzerland. I obtained myself a pretty good series of those objects through Mr. Jacob Messikommer, the well known owner and explorer of the celebrated pile-work of Robenhausen, on the shore of Lake Pfäffikon, Canton of Zürich. This lake formerly extended farther inland, and the site of the lake-village is at present occupied by a formation of peat, containing a great variety of relics which illustrate the curious phase of existence of those lake-dwelling people. Among the objects in my collection I will mention stag's horn in a natural or worked state, frequently made into sockets for holding hatchets; bone awls and chisel-like instruments; saws, cutting implements, scrapers, arrow and spearheads of flint; stone axes and chisels, crushing-stones, whetstones; pieces exhibiting the method employed in sawing and splitting stone for making axes, etc.; pottery, plain and ornamented, in fragments and in the shape of complete vessels; articles of wood, such as floaters for nets, twirling-sticks, etc. Of particular interest are the specimens of cloth, woven from flax, and perfectly preserved, owing to the carbonized state in which they occur. In the same condition are the numerous vegetable remains found in the peat around the piles. The most im-

portant, of course, are those that served as food; for instance, ears of wheat and barley, and agglomerations or lumps of grains of these cereals. Millet was likewise found, but no rye. Even pieces of wheat-bread, in which the grains can be plainly seen, have been preserved. There are small apples cut in halves, hazelnuts, beechnuts, raspberry-seeds, stones of the wild plum, and other eatable productions of the vegetable kingdom. Flax sometimes occurs in fibres already prepared for spinning.

The fauna of that period is represented by a great number of animals, the osseous remains of which Mr. Messikommer obtains in large quantities from the peat. Some of these animals differ from the species now existing. The bones found at Robenhausen are always examined and classified by Professor Rütimeyer, one of the best osteologists of our time. The pile-work in question belongs to that remote period in which the use of metals was not yet known, and articles of bronze, therefore, are not found at this place. Mr. Messikommer, however, is in constant communication with the archæologists of Switzerland, and is thus enabled to procure by exchange the objects of bronze occurring in the Palafittes of later periods. He informed me some time ago that he is now prepared to furnish the typical objects of bronze, such as arrow and spearheads, knives, sickles, fish-hooks, ornaments, etc. His prices, of course, vary according to the character and condition of the specimens; but I can state from personal experience that they are low, considering the great labor and time it requires to obtain these remarkable tokens of the past. Mr. Messikommer is a gentleman of well established character, and the objects offered by him may be relied upon as being perfectly genuine. I will with pleasure give more detailed information to collectors who wish to enter into communication with Mr. Messikommer. — CHARLES RAU, *New York, February*, 1873.

MICROSCOPY.

SECTIONS OF THE ORGANS OF HEARING. — The following hints, abstracted from the papers of Mr. H. N. Moseley and Dr. U. Pritchard in the "Quarterly Journal of Microscopical Science," will be of use to beginners, not only in preparing the organ referred to, but in dealing with many cases involving some of the same difficulties. A guinea-pig is the most desirable subject, though the cat, dog, rabbit, rat, or other animals may be used. The ani-

mal is killed, the head removed, the lower jaw disarticulated, and the two tympanic bullæ exposed. One of these is opened and the cochlea, projecting into its cavity, removed and immersed in a half per cent. solution of chromic acid in water. The acid should be changed twice a week, and in about two weeks the soft tissues will be sufficiently hardened, and the bony parts may be softened enough for slicing with a razor. If not, one two-hundredth part of nitric or muriatic acid is to be added to the solution, and in from one day to three weeks, according to the hardness of the bone, the sections can be made. To support the internal parts while cutting, the cavity must be filled up. For this purpose inject the cavity with a hot solution of gelatine; or immerse it in a mixture of wax and cocoa butter melted together, and exhaust the air under a receiver of an air pump so that the melted wax can run in; or soak it, for an hour or two, in a thick solution of gum arabic contained in a paper bag, and then put the bag in absolute alcohol for a day or two when the water will be sufficiently extracted to leave the gum in a tough state (methylated spirit may be substituted for the absolute alcohol). The whole organ thus prepared is to be imbedded in the mixture of wax and cocoa butter,—or wax and sweet oil,—or lard one part, spermaceti two parts, and paraffine five parts, melted together over a water bath,—and sections cut with a very sharp razor. The sections are to be floated off, stained with carmine, and mounted in glycerine or in acetate of potash (acetate of potash two ounces, hot water one ounce, dissolve and cool; add spirits of camphor thirty drops, and filter); or transferred through water, absolute alcohol, and oil of cloves to dammar varnish or Canada balsam.

Probable Nature of the Nerve Current.—Dr. L. S. Beale discusses this question in the "Monthly Microscopical Journal," and furnishes some very interesting speculations which are especially valuable from the author's eminent familiarity with the subject.

The active part of the nerve fibre distributed to the peripheral organ which receives the impressions is described as consisting invariably of a pale, very transparent, faintly granular, but in the natural state perfectly invisible cord. Between this and the central origin, in man and the higher animals, intervenes a more or less extended system of nerve cords through which impressions

pass with great rapidity. The part of these nerve cords capable of transmitting nervous impressions is generally conceded to be the axis cylinder, a thin, thread-like cord of extremely simple structure, never resembling the terminal network, and always surrounded by the medullary sheath, a white, fatty, albuminous substance of at least ten times its diameter, which seems calculated to insulate and protect it. This medullary sheath, or white substance of Schwann, is also little permeable to aqueous or albuminous solutions, and would preserve a uniform degree of moisture in the axis cylinder. The axis cylinder seems almost like an elongated band of white fibrous tissue. But little structural peculiarity has been demonstrated in it, and it is probably most remarkable for the perfect continuity of its parallel strata. The author believes that whatever changes take place in it might occur in other forms of tissue; indeed that such changes do occur in all tissues, but that only here are they so insulated that their variations become evident. If the axis cylinder could be replaced by a long filament of ordinary fibrous tissue, he would feel almost justified in expecting the nerve current to be as well conducted as by the axis cylinder itself.

That the nerve current is some unknown form of energy, different from heat, electricity, etc., but correlated with them, is mentioned as the prevalent belief of physiologists. It is deemed unphilosophical to explain phenomena by some conjectural force rather than by those we know something about; and the excellent opportunity for the author's favorite tilt at the physicists is taken advantage of with undisguised enthusiasm.

The chemical theory of the nerve current is still less admissible. The axis cylinder is a firm, tough, fibrous-like band, evidently of slow growth, little prone to rapid change, and only in imagination capable of rapid disintegration and reconstruction. Its action cannot be performed by chemical decomposition of its particles, especially as it is surrounded by ten times its thickness of myelin (medullary sheath) one of the least permeable substances in the body, and one of the least suitable media through which to take up new material or get rid of products of decay.

The vibratory theory is equally inconsistent with the structure of the axis cylinder, which is not well calculated to propagate motor impulses and which varies greatly in different parts of its course. The thickness of the medullary sheath, and its greater

development where nerves run parallel to one another are mentioned by the author as incompatible with this theory; though it is not inconceivable that such insulation should be as essential to other vibrations as to electrical movements.

That nerve fibre is a peculiarly vital form of tissue, pervaded by some exceptional form of force nowhere else present, seems entirely to want confirmation.

That the nerve current is ordinary electricity, transmitted through the beautifully insulated axis cylinder, though not proved, is considered more than probable, notwithstanding the somewhat incongruous result obtained by rough experiments, such as transmitting more powerful currents through mutilated nerves, or through nerves and other tissues after the post mortem changes, or at a rate slower than through copper wire, no allowance being made for the less perfect conducting power of a moist fibrous cord. No one has disproved the electrical character of the nerve current, while such character is strongly supported by a multitude of well determined facts, especially those connected with the electrical organs of some of the lower animals, where electricity is set free in special organs rich in nerves but not essentially different from other nerve organs.

How the course of the electrical current is directed and varied, and how subjected to the control of the will, are independent questions not yet answered.

Insects' Feet as Carriers of Dirt. — Prof. W. Kletzinsky, of Vienna, has detected with the microscope an abundance of foreign particles in pure glycerine into which flies had stepped and from which they had succeeded in freeing themselves; thus vindicating the belief that flies may become carriers of contagious diseases.

Circulation in Insects. — Mr. R. King read an interesting paper on this subject at the Dubuque meeting of the American Association. By a microscopical study of insects during periods of dormancy or hibernation, some forms of larvæ, especially, being so transparent that the microscope gains a perfect view of their internal organs without interfering with them, he is satisfied that there is no circulation while the insect is at absolute rest, and that the ordinary circulation in insects is entirely the result of the voluntary muscular activity of the creatures.

THE WHITE BLOOD-CORPUSCLES A CONNECTING LINK. — The "closing address" before the Oldham Microscopical Society, by its retiring President, Mr. James Nield, alludes to the white corpuscles of human blood, their chemical composition, their ever changing form, their use in the economy of the body, and their nearly complete identity in form and chemical composition with the corresponding corpuscles in the blood of all the other vertebrate animals. He admits the conviction that these peculiar bodies are links connecting the humble rhizopods with the highest animals, in the former case floating in water and in the latter drifting in the plasma of the blood. He considers the naked amæba and the sarcode of the foraminiferous shell only free members of a family which are aggregated and communistic in the higher creatures from the sponge to man.

MARKINGS OF BATTLEDOOR SCALES. — Mr. T. W. Wonfer assured the Brighton and Sussex Natural History Society that while examining these scales with reference to Dr. Anthony's idea that the markings were tubercles on the ribs, he succeeded in obtaining a view of some scales standing on edge, in which cases he could see the tubercles standing out distinctly from the ribs. The scales should be examined from freshly killed insects, as they tend to become flattened in drying.

STRUCTURE OF INFUSORIA. — Prof. Edward Van Beneden questions the pleuricellular nature of the Infusoria. The belief that they were unicellular beings was generally abandoned as soon as their complex nature became known; but he has found the Gregarinæ, monocellular organisms, to attain a high degree of complication, and he conceives that the same may be true of the Infusoria.

THE GONIOMETER STAGE. — The glass sliding-stage, moving upon a circular plate having concentric and graduated rotation, has become, and is still more becoming, so important a contrivance in microscopy that its origin is a question of some importance. This stage seems to be known in Europe as Nachet's invention, and it was doubtless from his new style of Students' Microscope that it was adopted by the London makers. Mr. Joseph Zentmayer of Philadelphia, who had made the plain glass stage long before that time, constructed in the spring of 1859, for a Mr. Rosevelt of New York, a revolving glass stage which would be

minutely and quite accurately represented by Dr. Carpenter's description (The Microscope, London, 1868, pp. 68 and 69). He continued to make these stages, and in the year 1864 furnished one to Prof. Edwin Emerson, then of Paris, who took pains to show the American stand to those interested in microscopes and especially to the makers. In October of the same year Mr. (now Dr.) W. W. Keen of Philadelphia exhibited one of these stands, with a similar stage, to Nachet, and the following spring placed it in his hands for safe packing for return to this country. These goniometer stages were certainly substantially the same as those now made, and were probably equal to any of the latter in delicacy of adjustment and finish; and it would seem that the publicity then given to them should guarantee to their maker the credit for their invention, unless some other person should claim to have arranged, and in some way published, an identical contrivance at an earlier date.

NOTES.

In the construction of new cases for the birds in the museum of the Boston Society of Natural History, we learn from the report of the custodian, Prof. Hyatt, "that extraordinary precautions were taken in order to render these cases absolutely insect-tight. The lumber was very carefully selected and kept heated while the work was going on, all joints were tongued, grooved and glued. The tops, bottoms and sides, were built into the plastering, the sashes grooved and tongued and locked by wedge-shaped bolts. The latter were invented in order to draw the sashes up tightly and firmly against the tongues at the top and bottom, and completely close the fronts of each case. Morse's patent brackets were used to suspend the shelving, which hangs upon the wall, and has no connection with the fronts. The success of these precautions is shown by the air-tight condition of the cases. By suddenly opening or closing a sash, one could readily crush in, or burst out, the neighboring glass panes. The resistance of the air is so great that it has to be overcome by a steady slow pressure as if one was working the handle of a piston. With the exception of the method of bolting, and some other details, this plan is similar to that which has been successfully adopted by the Smithsonian Institution for the preservation of their valuable collection of birds, and was recommended to us by Professor Baird.

"The entire collection of Coleoptera has been placed in insect-proof boxes by Mr. Sprague, and he has begun to secure the Harris collection in a similar manner. I desire, however, to call the attention of the society to the boxes upon the table. These are experiments upon the methods of mounting and illustrating the typical collection of insects, and will probably be adopted throughout that department. The difficulties that were overcome, and amount of study and labor expended by Mr. Sprague in making these pattern boxes, can only be rightly appreciated by those who have watched their progress. One of them exhibits the ventral and dorsal aspects of a large beetle, showing all the parts appropriately named. This is to be the type of the order. The other boxes contain the types of several genera and two families. The enlarged outlines of these small insects are given from the dorsal and ventral sides, accompanied by specimens having a similar position. On the right hand side of the box in each case are the characteristic parts, likewise greatly enlarged, so as to be readily seen, but each figure accompanied by its corresponding dissection. The characteristics of the family and genus are written opposite, so that the visitor sees at one glance the animal, its parts, and the family and generic characteristics. The outlines are drawn with the camera lucida, and corrected by the most careful study, so that they are as accurate as it is possible to make them."

Prof. Shaler of Harvard College at the last meeting of the American Educational Association followed with an address upon "The Method of Teaching Natural History." This, he said, as practised by him, embodied the same leading principles as had just been suggested by Prof. Pickering, the aim being to give the student a practical quite as much as a theoretical knowledge of the science. No text-book served as the basis of teaching, as it was quite insufficient for thorough instruction. A student in the first course is directed as his first lesson to go forth into nature and catch some kind of a living creature for study. It was no matter what he caught, whether a fly, a bird or a serpent. Having made a capture, the student is told to observe the creature and note down his observations. No matter what he observes, nothing can be too trivial, the point being to teach him to use his eyes. His notes are reviewed by the teacher, and appropriate comment and suggestion made with regard to further inquiry. It was a trait of

human nature that the study of dead things is at first repugnant to us. Living things are always interesting. The student accordingly begins with these, and this experience has almost invariably the effect to awaken his genuine interest or enthusiasm in the phenomena of nature. This is the second point gained. With this his attention can be fastened upon dead specimens, and the laws of organization as ascertained through these can be taught. Following upon this the practice was to take up some one of the great sequences of nature as observable in the animal kingdom; such as is given by the series of the actinoid polypes. The highest class had during the past year gone through with a course holding up to view what is known upon the most pressing question of the times, namely, the origin of the human species. The essential features of this method was first brought into use in this country by Agassiz, the only changes being such as were required to make it applicable to large numbers of students and to extend it to a course of several years of required work in the university.

The London "Journal of Botany" for January contains an interesting biographical sketch of Friedrich Welwitsch, the eminent botanist and discoverer of the singular plant which bears his name. He was born in Germany in 1807, but spent a portion of his life in the employment of the Portuguese government as superintendent of various gardens, while he paid much attention to the fungi and algæ, especially of Portugal. But his chief work was in elaborating the immense collections of plants made in the interior of Africa during a series of journeys which lasted seven years. "It was during his residence at Sange that Dr. Welwitsch made the acquaintance of Dr. Livingstone, then (October, 1854) on his way to Loanda, having travelled the whole distance from Cape Town. The two travellers lived together for some time, and the meeting had the effect of determining Dr. Welwitsch on relinquishing an idea he had previously entertained of endeavoring to make his way across the continent to the Portuguese possessions on the east coast—a task which, as is well known, Livingstone successfully accomplished during the two following years." As the result of these difficult and dangerous journeys he formed the best and most extensive herbarium ever collected in tropical Africa. He was the author of several botanical papers of a high order of merit.

Mr. W. H. SEAMAN of Washington sends us the following note: "I send you by mail a small tin box containing minerals, which are specimens of an incrustation, forming on parts of the northern face of the Washington monument in this city. It is about two hundred feet high, unfinished, and the top protected by an imperfect shed of boards. The walls are gneiss faced with marble, and this curious stalagmite, for such it really is, appears to be formed by the water percolating from the top of the wall through the joints, and dissolving a part of the mortar which is deposited upon its outer surface. The deposits always commence at a joint and widen as they descend like the letter A, covering sometimes several square feet, usually firmly attached to the marble. The edifice has been built about twenty years. Mr. Clark, architect of the Capitol, states that a similar incrustation forms on the inside of the arches, under the capitol steps, but it is scraped off every year." It is certainly interesting as an example of natural deposit under artificial conditions.

WE are glad to inform our readers that the tax on alcohol, so grievous to museums, is to be removed when used for scientific purposes. According to the Boston "Journal" Prof. Agassiz's bill, as it is called, to remit the excise duties on alcohol used for scientific purposes, which was passed by the House on the 23d, was passed February 12th by the Senate, and will soon become a law. The bill provides that the alcohol can be withdrawn from bond by the Presidents or Curators of scientific institutions or colleges, for the sole and exclusive purpose of preserving specimens of anatomy, physiology or of natural history, or for use in any chemical laboratory of such institutions; and if any alcohol thus obtained shall be used for any other purposes than those specified, then the officers of the institution or their sureties shall pay the tax on the whole amount withdrawn from bond, together with a like amount as a penalty in addition thereto.

WE regret to announce the death of Prof. F. B. Maury, the author of the "Physical Geography of the Sea" and of "Sailing Directions" for seamen.

THE Government has appropriated $75,000 for the continuance next year of Prof. Hayden's geological survey of the public lands, and $10,000 for the completion of the reports of Mr. Powell's expedition.

DR. O. NORDSTED describes in the sixth part of the "Ofversigt" of the Stockholm Academy of Sciences for 1872 the Desmidiaceæ collected by the Swedish expeditions in 1868 and 1870 to Spitzbergen and Bear Island. Fifty species are enumerated, nine being described as new, and carefully figured.— *Journal of Botany.*

ANSWERS TO CORRESPONDENTS.

M. R. S., Canandaigua, N. Y. — The birds referred to by you are, as you supposed, the snow bunting (*Plectophanes nivalis*). and the snow bird (*Junco hyemalis*). Their habitat is given in Coues' "Key to North American Birds," and their habits are quite fully described in the works of Wilson, Audubon and Nuttall. — J. A. A.

BOOKS RECEIVED.

Bidrag till Ofversigt af sveriges ichthyologiska literatur. Akademisk Afhandlung som med vidtberomda filosofiska fakultetens i Upsala tillstand for Filosofiska Gradens erhallende till offentlig granskning framstalles af Fredrick Lundberg. 8vo pamph. pp. 56. Stockholm. 1872.

List de Coleopteres Exotiques en vente chez A. Boucard. No. 8. 12mo pamph. pp. 28. London.

Account of the Exploration of Mammoth Cave. By L. S. Burbank. (From Proc. Bost. Soc. Nat. Hist.) 8vo. pp. 2.

On the Gigantic Fossil Mammals of the order Dinocerata. By O. C. Marsh. (From Am. Jour. Sci. and Arts, Feb., 1873.) 8vo. pp. 8, 2 plates. Received Jan. 29, 1873

Half-hour Recreations in Popular Science. Unconscious Action of the Brain and Epidemic Delusions. By W. B. Carpenter. 12 mo. pp. 64. Boston, 1872.

Third and Fourth Annual Reports of the Geological Survey of Indiana, made during the years 1871 *and* 1872. By E. T. Cox. 8vo. pp. 488. Indianapolis, 1872.

Maps for Geological Survey of Indiana. 8vo. 1872.

The History of Balanoglossus and Tornaria. By Alexander Agassiz. 4to. pp. 16. Plate 3. Cambridge, 1873.

Entomologische Zeitung. 8vo. pp. 494. With 2 plates. Stettin, 1872.

The Microscope and Microscopical Technology. By Heinrich Frey. Translated from the German by George R. Cutter. 8vo. pp. 658. Illustrated by 343 engravings. New York, 1872.

Jahrbuch der kaiserlich-koniglichen geologischen Reichsanstalt. Band XXII. No. 3. 8vo. pp. 77. 4 plates. *Mineralogische Mittheilungen gesammelt von Gustav Tschermak.* Jahrgang, 1872. Heft 3. pp. 82. 2 plates. Wien, 1872.

Verhandlungen der k. k. geologischen Reichsanstalt. Nos. 11, 12 and 13. 8vo. Wien, 1872.

Recherches Physico-chimiques sur les Articules Aquatiques. Part I. Par Felix Plateau. 4to. pp. 66. Bruxelles, 1870. Part II. 8vo. pp 50. Bruxelles, 1872.

Materiaux pour la faune Belge. Deuxieme Note. Myriapodes. Par Felix Plateau. 8vo. pp. 21. 1 plate. Bruxelles, 1872.

Qu'est-ce que l'aile d'un Insecte. Par Felix Plateau. 8vo. pp. 10. 2 plates.

Tidsskrift for Populære Fremstillinger af Naturvidenskaben. Fjerde Række. Fjerde Binds. Sjette Hefte. 8vo. Kjobenhaven, 1872.

Proceedings of the New England Historic-Genealogical Society, at the Annual Meeting, January 1, 1873. 8vo. pp. 44. Boston.

Arrangement of the Families of Mammals. (From Smithsonian Miscellaneous Collections.) By Theodore Gill. 8vo. pp. 98. Washington, 1872.

Fourteenth Annual Report of the Indiana State Board of Agriculture, 1872, including the Report of Professor E. T. Cox, State Geologist, for 1871 *and* 1872. 8vo. pp. 432. Indianapolis.

Twentieth Report of the Superintendent of Public Instruction for the State of Indiana. 8vo. pp. 424. Indianapolis, 1872.

Diagram showing the Progress of the Anthracite Coal Trade of Pennsylvania. By P. W. Sheafer.

Results of Recent Dredging Expeditions on the Coast of New England. (From Am. Jour. Sci. and Arts.) By A. E. Verrill. 8vo. pp. 9. January 18, 1873.

Land and Water. London. Nos. for Dec. 28, 1872; Jan. 4, 18, 25, Feb. 1, 1873.

The Field. London. Nos. for Dec. 28, 1872; Jan. 4, 18, 25, Feb. 1, 1873.

Nature. London. Nos. for Dec., 1872; Jan. 9, 16, 23, 1873.

The Academy. London. Nos. for Dec. 15, 1872; Jan. 1, 15, Feb. 1, 1873.

The American Journal of the Medical Sciences. Philadelphia. Jan., 1873.

The Popular Science Monthly. New York. Jan. and Feb., 1873.

Bulletin Mensuel de la Societe d'Acclimatation. Paris. Tome ix. Nos. for Aug., Sept. and Oct., 1872.

Bulletin de la Societe des Sciences Naturelles de Neuchatel. Neuchatel. Tome ix. Cahier 2. 1872.

Le Naturaliste Canadien. Quebec. Vol. v, No. 1. Jan., 1873.

The Journal of Applied Science. London. Vol. iii. Nov. 1, 1872.

Bulletin of the Torrey Botanical Club. New York. Vol. iv, No. 1. 1873.

Revue Scientifique. Paris. Jan. 18, 25, Feb. 1, 1873.

The American Journal of Science and Arts. New Haven. Vol v. Feb., 1873.

Journal of the Franklin Institute. Philadelphia. Jan. and Feb., 1873.